09/601723
5630

Copy for the International Preliminary Examining Authority (IPEA/US)

PCT/IL97/00012

PATENT COOPERATION TREATY

PCT

From the INTERNATIONAL BUREAU

To:

PYERNIK, Moshe
Luzzatto & Luzzatto
P.O. Box 5352
Beer-Sheva 84 152
ISRAËL

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

Date of mailing (day/month/year)
01 May 1998 (01.05.98)

Applicant's or agent's file reference
26392

IMPORTANT NOTIFICATION

International application No.
PCT/IL97/00012

International filing date (day/month/year)
08 January 1997 (08.01.97)

1. The following indications appeared on record concerning:

[X] the applicant [ ] the inventor [ ] the agent [ ] the common representative

Name and Address
NEW TECHNOLOGIES (SA-YSY) LTD.
P.O. Box 8044
31080 Haifa
Israel

State of Nationality: IL
State of Residence: IL
Telephone No.:
Facsimile No.:
Teleprinter No.:

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[ ] the person [ ] the name [X] the address [ ] the nationality [ ] the residence

Name and Address
NEW TECHNOLOGIES (SA-YSY) LTD.
3 Haetgar St.
Carmel Building
P.O. Box 2044
Tirat Hacarmel, 39120
Israel

State of Nationality: IL
State of Residence: IL
Telephone No.:
Facsimile No.:
Teleprinter No.:

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

[X] the receiving Office
[ ] the International Searching Authority
[X] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer
Beatriz Morariu

Telephone No.: (41-22) 338.83.38

Copy for the Elected Office (EO/US)

PCT/IL97/00012

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

To:

PYERNIK, Moshe
Luzzatto & Luzzatto
P.O. Box 5352
Beer-Sheva 84 152
ISRAËL

Date of mailing (day/month/year)
01 May 1998 (01.05.98)

Applicant's or agent's file reference
26392

IMPORTANT NOTIFICATION

International application No.
PCT/IL97/00012

International filing date (day/month/year)
08 January 1997 (08.01.97)

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[X] the applicant [ ] the inventor [ ] the agent [ ] the common representative

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2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

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[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer
Beatriz Morariu

Telephone No.: (41-22) 338.83.38

Copy for the International Preliminary Examining Authority (IPEA/US)

PCT/IL97/00012

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

To:

PYERNIK, Moshe
Luzzatto & Luzzatto
P.O. Box 5352
Beer-Sheva 84 152
ISRAËL

Date of mailing (day/month/year)
22 May 1998 (22.05.98)

Applicant's or agent's file reference
4410/WO/97

IMPORTANT NOTIFICATION

International application No.
PCT/IL97/00012

International filing date (day/month/year)
08 January 1997 (08.01.97)

1. The following indications appeared on record concerning:

[X] the applicant [ ] the inventor [ ] the agent [ ] the common representative

Name and Address
NEW TECHNOLOGIES (SA-YSY) LTD.
P.O. Box 8044
31080 Haifa
Israel

State of Nationality: IL
State of Residence: IL
Telephone No.:
Facsimile No.:
Teleprinter No.:

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

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Name and Address
NEW TECHNOLOGIES (SA-YSY) LTD.
3 Haetgar St.
Carmel Building
P.O. Box 2044
Tirat Hacarmel, 39120
Israel

State of Nationality: IL
State of Residence: IL
Telephone No.:
Facsimile No.:
Teleprinter No.:

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

[X] the receiving Office
[ ] the International Searching Authority
[X] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer
Athina Nickitas-Etienne

Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

To:

PYERNIK, Moshe
Luzzatto & Luzzatto
P.O. Box 5352
Beer-Sheva 84 152
ISRAËL

Date of mailing (day/month/year)
22 May 1998 (22.05.98)

Applicant's or agent's file reference
4410/WO/97

IMPORTANT NOTIFICATION

International application No.
PCT/IL97/00012

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The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer
Athina Nickitas-Etienne

Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION CONCERNING SUBMISSION OF PRIORITY DOCUMENTS

(PCT Administrative Instructions, Section 411)

To:

SANFORD, T., Colb
Sanford T. Colb & Co.
P.O. Box 2273
76122 Rehovot
ISRAËL

Date of mailing (day/month/year)
05 August 1997 (05.08.97)

Applicant's or agent's file reference
26392

IMPORTANT NOTIFICATION

International application No.	**International filing date** (day/month/year)	**Priority date** (day/month/year)
PCT/IL97/00012	08 January 1997 (08.01.97)	08 January 1996 (08.01.96)

Applicant

NEW TECHNOLOGIES (SA-YSY) LTD. et al

The applicant is hereby notified of the date of receipt by the International Bureau of the priority document(s) relating to the following application(s):

Priority application No:	Priority date:	Priority country:	Date of receipt of priority document:
60/009,769	11 Jan 1996 (11.01.96)	US	24 Jul 1997 (24.07.97)
60/011,117	05 Feb 1996 (05.02.96)	US	24 Jul 1997 (24.07.97)
60/026,392	16 Sep 1996 (16.09.96)	US	24 Jul 1997 (24.07.97)

The date of receipt was not within the limits referred to in Rule 17.1(a). **Attention:** this time limit was calculated by computer according to Rule 80.2 without regard to whether the last day of the time limit was a non-working day other than a Saturday or Sunday (Rule 80.5)

The applicant's attention is drawn to Rule 17.1(c) which provides that a **designated Office may disregard a priority claim** if the priority document is not submitted, or if the applicant's request to the receiving Office to transmit the priority document to the International Bureau is not validly made, within the time limit of 16 months from the priority date.

For detailed information regarding a particular designated Office, see Annexes B1 and B2 of Volume I of the PCT Applicant's Guide.

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

Beatriz Morariu

Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

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(PCT Administrative Instructions, Section 411)

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Sanford T. Colb & Co.
P.O. Box 2273
76122 Rehovot
ISRAËL

Date of mailing (day/month/year)
23 September 1997 (23.09.97)

Applicant's or agent's file reference
26392

IMPORTANT NOTIFICATION

International application No.	**International filing date** (day/month/year)	**Priority date** (day/month/year)
PCT/IL97/00012	08 January 1997 (08.01.97)	08 January 1996 (08.01.96)

Applicant
NEW TECHNOLOGIES (SA-YSY) LTD. et al

The applicant is hereby notified of the date of receipt by the International Bureau of the priority document(s) relating to the following application(s):

Priority application No:	Priority date:	Priority country:	Date of receipt of priority document:
08/595,365	01 Feb 1996 (01.02.96)	US	12 Sep 1997 (12.09.97)

The date of receipt was not within the limits referred to in Rule 17.1(a). **Attention:** this time limit was calculated by computer according to Rule 80.2 without regard to whether the last day of the time limit was a non-working day other than a Saturday or Sunday (Rule 80.5)

The applicant's attention is drawn to Rule 17.1(c) which provides that **a designated Office may disregard a priority claim** if the priority document is not submitted, or if the applicant's request to the receiving Office to transmit the priority document to the International Bureau is not validly made, within the time limit of 16 months from the priority date.

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The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer
Beatriz Morariu

Telephone No.: (41-22) 338.83.38

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IL97/00012

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :A61N 1/00
US CL :607/002

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 606/001, 014, 032, 033, 041, 042; 607/002, 004-007, 009, 015, 088, 092, 115, 119, 123

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 4,559,947 A (RENGER et al) 24 December 1985, Abstract; and col. 3, lines 1-61.	1-26, 29-44, 106-114, 117-122, 132-143, 178-190, 193, 229, 237, 241-243, 246 --- 47-49, 51-102, 123-129, 191, 192, 194, 195, 230-236, 238-240

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 04 APRIL 1997	Date of mailing of the international search report 07 MAY 1997
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer ROSILAND S. KEARNEY Telephone No. (703) 308-2711

Form PCT/ISA/210 (second sheet)(July 1992)*

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IL97/00012

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 5,184,620 A (CUDAHY et al) 9 February 1993, Abstract; and col. 3, lines 23-68.	28, 145-151, 203 --- 204-223
X ---P Y	US 5,549,646 A (KAYZ et al) 27 August 1996, Abstract; and col. 3, lines 23-34.	26, 27, 152-161, 167, 196, 202 --- 162-166, 168-177, 197-201
X --- Y	US 5,443,489 A (BEN-HAIM) 22 August 1995, col. 3, lines 44-62.	45, 46, 224 --- 50, 103, 104, 115, 116, 225-228
Y	US 4,971,058 A (PLESS et al) 20 November 1990, col. 2, lines 25-68.	130, 131
Y	US 5,281,219 A (KALLOK) 25 January 1994, col. 1, lines 41-60.	244, 245

Copy for the designated Office (DO/US)

PCT/IL97/00012

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION CONCERNING SUBMISSION OF PRIORITY DOCUMENTS

(PCT Administrative Instructions, Section 411)

To:

PYERNIK, Moshe
Luzzatto & Luzzatto
P.O. Box 5352
Beer-Sheva 84 152
ISRAËL

Date of mailing (day/month/year) 10 November 1997 (10.11.97)	
Applicant's or agent's file reference 26392	**IMPORTANT NOTIFICATION**

International application No.	**International filing date** (day/month/year)	**Priority date** (day/month/year)
PCT/IL97/00012	08 January 1997 (08.01.97)	08 January 1996 (08.01.96)

Applicant

NEW TECHNOLOGIES (SA-YSY) LTD. et al

The applicant is hereby notified of the date of receipt by the International Bureau of the priority document(s) relating to the following application(s):

Priority application No:	Priority date:	Priority country:	Date of receipt of priority document:
08/595,365	01 Feb 1996 (01.02.96)	US	12 Sep 1997 (12.09.97)

The date of receipt was not within the limits referred to in Rule 17.1(a). **Attention:** this time limit was calculated by computer according to Rule 80.2 without regard to whether the last day of the time limit was a non-working day other than a Saturday or Sunday (Rule 80.5)

The applicant's attention is drawn to Rule 17.1(c) which provides that **a designated Office may disregard a priority claim** if the priority document is not submitted, or if the applicant's request to the receiving Office to transmit the priority document to the International Bureau is not validly made, within the time limit of 16 months from the priority date.

For detailed information regarding a particular designated Office, see Annexes B1 and B2 of Volume I of the PCT Applicant's Guide.

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

Beatriz Morariu

Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION CONCERNING DOCUMENT TRANSMITTED

To:

United States Patent and Trademark Office
(Box PCT)
Crystal Plaza 2
Washington, DC 20231
ETATS-UNIS D'AMERIQUE

in its capacity as designated Office

Date of mailing (day/month/year)	
05 August 1997 (05.08.97)	
International application No.	**International filing date** (day/month/year)
PCT/IL97/00012	08 January 1997 (08.01.97)

Applicant

NEW TECHNOLOGIES (SA-YSY) LTD. et al

The International Bureau transmits herewith the following documents and number thereof:

_____ cop(ies) of priority document(s) (Rule 17.2(a))

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

Beatriz Morariu

Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION CONCERNING DOCUMENT TRANSMITTED

To:

United States Patent and Trademark Office
(Box PCT)
Crystal Plaza 2
Washington, DC 20231
ETATS-UNIS D'AMERIQUE

in its capacity as designated Office

Date of mailing (day/month/year)
23 September 1997 (23.09.97)

International application No.
PCT/IL97/00012

International filing date (day/month/year)
08 January 1997 (08.01.97)

Applicant
NEW TECHNOLOGIES (SA-YSY) LTD. et al

The International Bureau transmits herewith the following documents and number thereof:

_____ cop(ies) of priority document(s) (Rule 17.2(a))

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer
Beatriz Morariu

Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION CONCERNING REPRESENTATION

(PCT Administrative Instructions, Section 425

To:

United States Patent and Trademark Office
(Box PCT)
Crystal Plaza 2
Washington, DC 20231
ETATS-UNIS D'AMERIQUE

Date of mailing (*day/month/year*)	
01 October 1997 (01.10.1997)	
International application No.	International filing date (*day/month/year*)
PCT/IL97/00012	08 January 1997 (08.01.1997)
Applicant	
NEW TECHNOLOGIES (SA-YSY) LTD.	

1. The International Bureau hereby gives notice of the receipt of a document containing:

- [x] a power of attorney
- [ ] a revocation of power of attorney
- [ ] a renunciation of appointment

2. This notification, together with a copy of the document indicated above, is sent to the addressee in its capacity as:

- [ ] the receiving Office.
- [ ] the International Searching Authority.
- [x] the international Preliminary Examining Authority.

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer Nicola Wolff
Facsimile No. (41-22) 740.14.35	Telephone No. (41-22) 338.83.38

Form PCT/IB/319 (July 1992)

PCT

GENERAL POWER OF ATTORNEY

(for an international application filed under the Patent Cooperation Treaty)

(PCT Rule 90.5)

The undersigned person(s)
(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

NEW TECHNOLOGIES (SA-YSY) LTD.
15 Bat Galim Avenue, P.O.Box 8044, Haifa 31080, Israel

hereby appoints (appoint) the following person as: ☒ agent ☐ common representative

Name and address
(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

LUZZATTO, Kfir; LUZZATTO, Edgar; LUZZATTO, Esther; FUERST, Zadok;
PYERNIK, Moshe; FEIGELSON, Daniel; PRICE, Eyal; SHALEV, Ronit;
LUZZATTO & LUZZATTO
P.O.Box 5352, Beer-Sheva 84 152
Israel

to represent the undersigned before
☒ all the competent International Authorities
☐ the International Searching Authority only
☐ the International Preliminary Examining Authority only

in connection with any and all international applications filed by the undersigned with the following Office:

The Israeli Patents and Trademarks Office as receiving Office, and to make or receive payments on behalf of the undersigned.

Signature of the applicant(s) *(where there are several applicants, each of them must sign; next to each signature, indicate the name of the person signing and the capacity in which the person signs, if such capacity is not obvious from reading the request or this power):*

Nissi

NEW TECHNOLOGIES (SA-YSY) LTD.
By: Nissim Davish - General Director

טכנולוגיות חדשות (סע-ישי) בע"מ
New Technologies (SA-YSY) Ltd.
ח.פ. 512263955

Date: 7 - July - 1997

Form PCT/Model of power of attorney

PCT

POWER OF ATTORNEY

(for an international application filed under the Patent Cooperation Treaty)

(PCT Rule 90.4)

The undersigned applicant(s) *(Names should be indicated as they appear in the request)*:

BEN-HAIM, Shlomo
101 Yeffy Nof Avenue, Haifa 34454, Israel

hereby appoints (appoint) the following person as: ☒ agent ☐ common representative

Name and address
(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

LUZZATTO, Kfir; LUZZATTO, Edgar; LUZZATTO, Esther; FUERST, Zadok;
PYERNIK, Moshe; FEIGELSON, Daniel; PRICE, Eyal; SHALEV, Ronit;
LUZZATTO & LUZZATTO
P.O.Box 5352, Beer-Sheva 84 152
Israel

to represent the undersigned before

☒ all the competent International Authorities
☐ the International Searching Authority only
☐ the International Preliminary Examining Authority only

in connection with the international application identified below:

Title of the invention: ELECTRICAL MUSCLE CONTROLLER

Applicant's or agent's file reference: 4410/WO/97

International application number (if already available): PCT/IL97/00012

filed with the following Office Israeli Patents and Trademarks Office as receiving Office and to make or receive payments on behalf of the undersigned.

Signature of the applicant(s) *(where there are several applicants, each of them must sign; next to each signature, indicate the name of the person signing and the capacity in which the person signs, if such capacity is not obvious from reading the request or this power):*

BEN-HAIM, Shlomo

Date: 4/8/97

Form PCT/Model of power of attorney (for a given international application) (July 1992)

PCT

POWER OF ATTORNEY

(for an international application filed under the Patent Cooperation Treaty)

(PCT Rule 90.4)

The undersigned applicant(s) *(Names should be indicated as they appear in the request)*:

DARVISH, Nissim
22a Hantke Street, Haifa 34606, Israel

hereby appoints (appoint) the following person as: ☒ agent ☐ common representative

Name and address
(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

LUZZATTO, Kfir; LUZZATTO, Edgar; LUZZATTO, Esther; FUERST, Zadok;
PYERNIK, Moshe; FEIGELSON, Daniel; PRICE, Eyal; SHALEV, Ronit;
LUZZATTO & LUZZATTO
P.O.Box 5352, Beer-Sheva 84 152
Israel

to represent the undersigned before

☒ all the competent International Authorities
☐ the International Searching Authority only
☐ the International Preliminary Examining Authority only

in connection with the international application identified below:

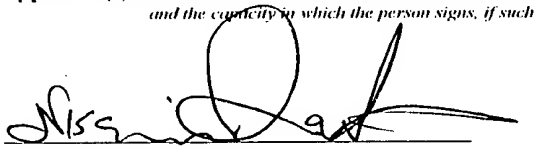
Title of the invention: ELECTRICAL MUSCLE CONTROLLER

Applicant's or agent's file reference: 4410/WO/97

International application number (if already available): PCT/IL97/00012

filed with the following Office Israeli Patents and Trademarks Office as receiving Office and to make or receive payments on behalf of the undersigned.

Signature of the applicant(s) *(where there are several applicants, each of them must sign; next to each signature, indicate the name of the person signing and the capacity in which the person signs, if such capacity is not obvious from reading the request or this power)*:



DARVISH, Nissim

Date: 19-8-97

Form PCT/Model of power of attorney (for a given international application) (July 1992)

PCT

POWER OF ATTORNEY

(for an international application filed under the Patent Cooperation Treaty)

(PCT Rule 90.4)

The undersigned applicant(s) *(Names should be indicated as they appear in the request)*:

FENSTER, Maier
61 Brande Street, Petach Tikva 49600, Israel

hereby appoints (appoint) the following person as: ☒ agent ☐ common representative

Name and address
(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

LUZZATTO, Kfir; LUZZATTO, Edgar; LUZZATTO, Esther; FUERST, Zadok;
PYERNIK, Moshe; FEIGELSON, Daniel; PRICE, Eyal; SHALEV, Ronit;
LUZZATTO & LUZZATTO
P.O.Box 5352, Beer-Sheva 84 152
Israel

to represent the undersigned before

☒ all the competent International Authorities
☐ the International Searching Authority only
☐ the International Preliminary Examining Authority only

in connection with the international application identified below:

Title of the invention: ELECTRICAL MUSCLE CONTROLLER

Applicant's or agent's file reference: 4410/WO/97

International application number (if already available): PCT/IL97/00012

filed with the following Office Israeli Patents and Trademarks Office as receiving Office and to make or receive payments on behalf of the undersigned.

Signature of the applicant(s) *(where there are several applicants, each of them must sign; next to each signature, indicate the name of the person signing and the capacity in which the person signs, if such capacity is not obvious from reading the request or this power)*:

Maier Fenster
FENSTER, Maier

Date: 27-Aug-97

Form PCT/Model of power of attorney (for a given international application) (July 1992)

PCT

POWER OF ATTORNEY

(for an international application filed under the Patent Cooperation Treaty)

(PCT Rule 90.4)

The undersigned applicant(s) *(Names should be indicated as they appear in the request)*

MIKA, Yuval
49 Bet-Lechem Street, Haifa 35567, Israel

hereby appoints (appoint) the following person as: ☒ agent ☐ common representative

Name and address
(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

LUZZATTO, Kfir; LUZZATTO, Edgar; LUZZATTO, Esther; FUERST, Zadok;
PYERNIK, Moshe; FEIGELSON, Daniel; PRICE, Eyal; SHALEV, Ronit;
LUZZATTO & LUZZATTO
P.O.Box 5352, Beer-Sheva 84 152
Israel

to represent the undersigned before

☒ all the competent International Authorities
☐ the International Searching Authority only
☐ the International Preliminary Examining Authority only

in connection with the international application identified below:

Title of the invention: ELECTRICAL MUSCLE CONTROLLER

Applicant's or agent's file reference: 4410/WO/97

International application number (if already available): PCT/IL97/00012

filed with the following Office Israeli Patents and Trademarks Office as receiving Office and to make or receive payments on behalf of the undersigned.

Signature of the applicant(s) *(where there are several applicants, each of them must sign; next to each signature, indicate the name of the person signing and the capacity in which the person signs, if such capacity is not obvious from reading the request or this power):*

MIKA, Yuval

Date: 19-8-97

Form PCT/Model of power of attorney (for a given international application) (July 1992)

Copy for the elected Office (EO/US)

PATENT COOPERATION TREAT

From the INTERNATIONAL BUREAU

PCT

COMMUNICATION IN CASES FOR WHICH NO OTHER FORM IS APPLICABLE

To:
PYERNIK, Moshe
Luzzatto & Luzzatto
P.O. Box 5352
Beer-Sheva 84 152
ISRAËL

Date of mailing (*day/month/year*) 10 November 1997 (10.11.1997)	
Applicant's or agent's file reference 4410/WO/97	**REPLY DUE** see paragraph 1 below
International application No. PCT/IL97/00012	International filing date (*day/month/year*) 08 January 1997 (08.01.1997)
Applicant NEW TECHNOLOGIES (SA-YSY) LTD.	

1. ☐ REPLY DUE within _____ months/days from the above date of mailing

☐ NO REPLY DUE, however, see below

☒ IMPORTANT COMMUNICATION

☐ INFORMATION ONLY

2. COMMUNICATION:

Please be informed that the "Applicant's or Agent's file reference" has, in accordance with the agent's request, been changed to read:

4410/WO/97 instead of **26392.**

cc: RO/IL
IPEA/US

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer Beatriz Morariu
Facsimile No. (41-22) 740.14.35	Telephone No. (41-22) 338.83.38

Form PCT/IB/345 (July 1992)

Copy for the International Preliminary Examining Authority (IPEA/US)

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

COMMUNICATION IN CASES FOR WHICH NO OTHER FORM IS APPLICABLE

To:
PYERNIK, Moshe
Luzzatto & Luzzatto
P.O. Box 5352
Beer-Sheva 84 152
ISRAËL

Date of mailing (*day/month/year*) 10 November 1997 (10.11.1997)	
Applicant's or agent's file reference 4410/WO/97	**REPLY DUE** see paragraph 1 below
International application No. PCT/IL97/00012	International filing date (*day/month/year*) 08 January 1997 (08.01.1997)
Applicant NEW TECHNOLOGIES (SA-YSY) LTD.	

1. ☐ REPLY DUE within _____ months/days from the above date of mailing

☐ NO REPLY DUE, however, see below

☒ IMPORTANT COMMUNICATION

☐ INFORMATION ONLY

2. COMMUNICATION:

Please be informed that the "Applicant's or Agent's file reference" has, in accordance with the agent's request, been changed to read:

4410/WO/97 instead of **26392.**

cc: RO/IL
IPEA/US

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer Beatriz Morariu
Facsimile No. (41-22) 740.14.35	Telephone No. (41-22) 338.83.38

Form PCT/IB/345 (July 1992)

JZZATTO & LUZZAT
Patent Attorneys

Dr. EDGAR LUZZATTO
Dr. KFIR LUZZATTO
Dr. ESTHER LUZZATTO

Dr. Emanuel Manzurola
Zadok Fuerst
Moshe Pyernik

LEGAL DEPARTMENT
Eyal Price, LL.B., LL.M.
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Branch Office: Twin Towers 1, 2nd Floor
33 Jabotinsky St., Ramat-Gan 52511
☎ (972-3) 6133827; Fax: (972-3) 6133829

March 30, 1998

Honorable Commissioner of
Patents & Trademarks
Box PCT
Washington, D.C. 20231

Response to Written Opinion in
International Patent Application: PCT/IL97/00012
Applicant: NEW TECHNOLOGIES (SA-YSY) LTD. ET AL
Filed: 08 January 1997
For: ELECTRICAL MUSCLE CONTROLLER
Docket: 4410/WO/97

Sir:

We herewith respectfully submit Applicants' response to the Written Opinion issued in this case. We hereby also respectfully draw your attention to the following important matters.

Representation

This firm represents the applicants in the above-identified international patent application. A notification of this fact was sent to WIPO on September 16, 1997, accompanied by appropriate new power of attorney. WIPO acknowledged the change and notified all interested offices, on 3 October 1997. A copy of the correspondence, powers of attorney and of the Notification is attached.

Unfortunately, the Written Opinion in this case was addressed to the previous attorneys of record, Darby & Darby. This firm never received a mailed copy of the Written Opinion.

We respectfully request that you update the records to reflect the fact that mail is to be addressed to our firm, so that any future communication is sent to us.

Mailing Date

The Written Opinion was received in our offices by fax on March 11, 1998. The faxed copy of the Written Opinion does not mention a mailing date. Therefore, Applicant has made all efforts to diligently respond within less than one month from the faxing date of the Written Opinion.

Wrong Priority Date

The Written Opinion mentions as the first priority date the date of 5 February 1996. This date is incorrect, and the correct date for the first priority is 8 January 1996 (IL 116699). We respectfully request that the record be corrected to reflect the priority date of 8 January 1996.

Finally, the Applicants and their attorneys wish to express their appreciation and thanks to the U.S. Patent and Trademark Office, and particularly to Mr. J. Love and to Mr. A. Ostrager, for their kind efforts and assistance in locating the file of this PCT application, and in timely providing us with a copy of the Written Opinion, in view of the problems encountered by the Applicants in this case.

Respectfully,

Kfir Luzzatto
LUZZATTO & LUZZATTO
KL:ba

Direct E-mail: luzz_kfr@luzzatto.co.il

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

United States Patent and Trademark Office
(Box PCT)
Crystal Plaza 2
Washington, DC 20231
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 26 August 1997 (26.08.97)	
International application No. PCT/IL97/00012	**Applicant's or agent's file reference** 26392
International filing date (day/month/year) 08 January 1997 (08.01.97)	**Priority date** (day/month/year) 08 January 1996 (08.01.96)
Applicant BEN-HAIM, Shlomo et al	

1. The designated Office is hereby notified of its election made:

   [X] in the demand filed with the International Preliminary Examining Authority on:

   11 July 1997 (11.07.97)

   [ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

   [ ] was not

   made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

Beatriz Morariu

Telephone No.: (41-22) 338.83.38

5000

09/101,723 5640

Corrected Copy

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To: S. PETER LUDWIG
DARBY & DARBY P.C.
805 THIRD AVENUE
NEW YORK, NY 10022-7513

RECD PCT 17 JUL 1998
WIPO PCT

NOTIFICATION OF TRANSMITTAL OF INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

Date of Mailing *(day/month/year)*	06 JUL 1998
Applicant's or agent's file reference: 26392	IMPORTANT NOTIFICATION

International application No.	International filing date *(day/month/year)*	Priority Date *(day/month/year)*
PCT/IL97/00012	08 JANUARY 1997	08 JANUARY 1996

Applicant
NEW TECHNOLOGIES (SA-YSY) LTD.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices)(Article 39(1))(see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/US	Authorized officer
Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	WILLIAM KAMM
Facsimile No. (703) 305-3230	Telephone No. (703) 308-2711

Form PCT/IPEA/416 (July 1992)★

PATENT COOPERATION TREATY

PCT

REC'D 17 JUL 1998
WIPO PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Corrected Copy

Applicant's or agent's file reference 26392	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/IL97/00012	International filing date *(day/month/year)* 08 JANUARY 1997	Priority date *(day/month/year)* 08 JANUARY 1996
International Patent Classification (IPC) or national classification and IPC IPC(6): A61N 1/00 and US Cl.: 607/002		
Applicant NEW TECHNOLOGIES (SA-YSY) LTD.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets.

☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority. (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 9 sheets.

3. This report contains indications relating to the following items:

- I [X] Basis of the report
- II [ ] Priority
- III [ ] Non-establishment of report with regard to novelty, inventive step or industrial applicability
- IV [ ] Lack of unity of invention
- V [X] Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI [ ] Certain documents cited
- VII [ ] Certain defects in the international application
- VIII [ ] Certain observations on the international application

Date of submission of the demand	Date of completion of this report
11 JULY 1997	01 JULY 1998
Name and mailing address of the IPEA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	Authorized officer WILLIAM E. KAMM
Facsimile No. (703) 305-3230	Telephone No. (703) 308-2994

Form PCT/IPEA/409 (cover sheet) (January 1994)★

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/IL97/00012

I. Basis of the report

1. This report has been drawn on the basis of *(Substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments)*:

☐ the international application as originally filed.

☒ the description, pages (See Attached) , as originally filed.
pages _____ , filed with the demand.
pages _____ , filed with the letter of _____.
pages _____ , filed with the letter of _____.

☒ the claims, Nos. (See Attached) , as originally filed.
Nos. _____ , as amended under Article 19.
Nos. _____ , filed with the demand.
Nos. _____ , filed with the letter of _____.
Nos. _____ , filed with the letter of _____.

☒ the drawings, sheets/~~fig~~ (See Attached) , as originally filed.
sheets/~~fig~~ _____ , filed with the demand.
sheets/~~fig~~ _____ , filed with the letter of _____.
sheets/~~fig~~ _____ , filed with the letter of _____.

2. The amendments have resulted in the cancellation of:

☒ the description, pages NONE.

☒ the claims, Nos. 59-246.

☒ the drawings, sheets/~~fig~~ NONE.

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the ~~Supplemental Box~~ Additional observations below (Rule 70.2(c)).

4. Additional observations, if necessary:

NONE

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/IL97/00012

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. STATEMENT

Novelty (N)	Claims	(Please See supplemental sheet)	YES
	Claims	(Please See supplemental sheet)	NO
Inventive Step (IS)	Claims	(Please See supplemental sheet)	YES
	Claims	(Please See supplemental sheet)	NO
Industrial Applicability (IA)	Claims	(Please See supplemental sheet)	YES
	Claims	(Please See supplemental sheet)	NO

2. CITATIONS AND EXPLANATIONS

Claims 1-4, 11-12, 16-22, 24-27, 30-33, 37, 39-41, 43-44, 46-47, 49-51, 54 and 57-58 lack novelty under PCT Article 33(2) as being anticipated by Svenson et al, No.5,172,699 because the document discloses a system for detecting the location of the heart problem and applies a correcting energy which may be bipolar or RF energy to electrodes to correct the heart action.

Claims 5-10, 13-14, 23, 28-29, 34-36, 38, 42, 48, 52-53 and 55-56 lack an inventive step under PCT Article 33(3) as being obvious over Svenson et al, No.5,172,699. Claims 5-10, 13-14 merely set forth intended uses. Claims 23, 52-53 and 55-56 differ only in the duplication over a plurality of heart cycles applications, Claims 28-29 and 48 add structure having no application in the device as claimed. Claims 36 and 38 differ only in the choice of electrodes.

Claims 15 and 45 lack an inventive step under PCT Article 33(3) as being obvious over Svenson et al, No.5,172,699 in view of Svenson et al, No. 5,154,501. Using a defibrillator with the system shown by Svenson et al, 5,172,699 is clearly a conventional expedient in the art to extend the capability of the system as shown by Svenson et al, 5,154,501.

---------- NEW CITATIONS ----------
US 5,172,699 A (SVENSON et al) 12 DECEMBER 1992 see entire document
US 5,154,501 A (SVENSON et al) 13 OCTOBER 1992 see entire document

Supplemental Box
(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: Boxes I - VIII

I. BASIS OF REPORT:

THIS REPORT HAS BEEN DRAWN ON THE BASIS OF THE DESCRIPTION,
PAGES, 1-57, AS ORIGINALLY FILED.
PAGES, NONE, FILED WITH THE DEMAND.
AND ADDITIONAL AMENDMENTS:
NONE

THIS REPORT HAS BEEN DRAWN ON THE BASIS OF THE CLAIMS,
NUMBERS, NONE, AS ORIGINALLY FILED.
NUMBERS, NONE, AS AMENDED UNDER ARTICLE 19.
NUMBERS, NONE, FILED WITH THE DEMAND.
AND ADDITIONAL AMENDMENTS:
CLAIMS 1-58, FILED WITH THE LETTER OF 30 MARCH 1998

THIS REPORT HAS BEEN DRAWN ON THE BASIS OF THE DRAWINGS,
SHEETS, 1-25, AS ORIGINALLY FILED.
SHEETS, NONE, FILED WITH THE DEMAND.
AND ADDITIONAL AMENDMENTS:
NONE

V. 1. REASONED STATEMENTS:
THE REPORT AS TO NOVELTY WAS POSITIVE (YES) WITH RESPECT TO CLAIMS 5-10,13-15,23,28,29,34-36,38,42,45,48,52-53,55,56.
THE REPORT AS TO NOVELTY WAS NEGATIVE (NO) WITH RESPECT TO CLAIMS 1-4,11-12,16-22,24-27,30-33,37, 39-41, 43-44,46-47, 49-51, 54 AND 57-58.
THE REPORT AS TO INVENTIVE STEP WAS POSITIVE (YES) WITH RESPECT TO CLAIMS NONE.
THE REPORT AS TO INVENTIVE STEP WAS NEGATIVE (NO) WITH RESPECT TO CLAIMS 1-58.
THE REPORT AS TO INDUSTRIAL APPLICABILITY WAS POSITIVE (YES) WITH RESPECT TO CLAIMS 1-58.
THE REPORT AS TO INDUSTRIAL APPLICABILITY WAS NEGATIVE (NO) WITH RESPECT TO CLAIMS NONE.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

International Patent Application: PCT/IL97/00012

Applicant:	NEW TECHNOLOGIES (SA-YSY) LTD. ET AL
Filed:	08 January 1997
For:	ELECTRICAL MUSCLE CONTROLLER
Examiner:	Rosalind Kearny
Docket:	4410/WO/97

RESPONSE TO WRITTEN OPINION

Honorable Commissioner of
Patents & Trademarks
Box PCT
Washington, D.C. 20231

Sir:

In connection with the Written Opinion mailed (date unknown) in the above-identified International Patent Application, Applicant respectfully responds as follows:

AMENDMENTS

Please amend the claims by replacing claims 1-246 with attached new claims 1-58. This amendment is made without prejudice.

The claims have been revised to streamline the claim set, and to emphasize and clearly point out the claimed invention.

GENERAL REMARKS

Applicant wishes to comment briefly on the claimed invention. The inventors have found that it is possible to modify the activity of the heart by applying thereto a non-excitatory electric field. As will be apparent to the skilled person, this finding, as well as the method and

apparatus based thereon, are extremely surprising, since the invention exploits a signal **which would not be expected to produce any reaction whatsoever**, because it is applied at a time when it is generally recognized that a signal cannot generate a propagating action potential. **The skilled person would never think of applying a signal to the heart in a manner which is universally expected to produce no result whatsoever**. And in fact, the prior art has never ever hinted at the usefulness of doing so.

It is therefore respectfully submitted that it is both novel and highly inventive to provide a method, and apparatus employing such method, which produce a desired result **by employing a signal which is not expected to produce a result**, and which is generally recognized in the art to be essentially "useless" for the purposes to which this invention is directed.

It should further be mentioned that the results obtained, as broadly described in the specification, are not only surprising and novel, but also of critical value to the life and welfare of heart patients. Therefore, it is respectfully submitted that the applicant is entitled to be granted a patent on the invention claimed in the present application.

The following comments highlight and emphasize the arguments raised in the letter accompanying the Demand and Amendment under Art. 34 PCT.

COMMENTS ON CITED PRIOR ART

With the above general remarks in mind, the specific references applied by the Examiner will now be briefly discussed.

The Examiner has cited Renger et al., U.S. Patent 4,559,947 as novelty destroying. It is respectfully submitted that Renger et al. does not describe non-excitatory signals. On the contrary, Renger et al. uses and exploits **excitatory signals, which are pacing signals**. It

should be noted that the non-excitatory signals of the invention, as applied according to the invention, **cannot function as pacing signals**, and therefore substantially differ from the signals employed by Renger et al.

Reference is made, for instance, to col. 2, lines 65-66, which clearly state: "The present invention is directed to a tissue stimulator, specifically a cardiac pacing apparatus..". The non-excitatory signals of the invention are not "tissue stimulators" and cannot be used for "cardiac pacing". This concept is, Applicant believes, now clearly spelled out in amended claim 1 and following claims. Furthermore, the invention makes it possible to control the force of contraction of the heart and other physiological parameters, and to obtain a complete cardiac control system, which Ranger et al. cannot accomplish and does not teach.

Renger et al. has also been cited to deny inventive step of a number of claims. The Examiner is correct in stating that providing different numbers of electrodes in different locations is not inventive *per se*. It is the use of such electrodes to deliver a non-excitatory electric field that is novel and inventive. The distinction between Renger et al. and the present invention is believed to be now clearly pointed out also in this respect, in the amended claims.

Cudahy et al., U.S. Patent 5,184,620, was cited as novelty destroying for some claims of the original claim set, and as affecting the inventive step of others. Cudahy et al. deal with the monitoring of heart activity, and with a choice of electrodes to be electrified as a result of a given condition.

While Applicant agrees with the Examiner that "the duration of the signal and the type of electrical signal provided [are] ... based on the intended effect of the device", it is respectfully submitted that an **unknown** effect cannot be among the "intended effects". In other words, since it was unknown in the art that a non-excitatory signal may produce an effect, there was no basis or incentive in the art to make any modifications to an electric arrangement so as to apply a non-excitatory signal. Since Cudahy et al. does not mention or hint at the usefulness of the non-excitatory signals of the invention, it adds nothing to the

known art which totally ignored the possibility to use such signals. Therefore, as clearly seen from the enclosed amended claims set, nothing of what is described in Cudahy et al. anticipates or hints at the invention, since the skilled person reading Cudahy et al. would find nothing in its disclosure to prime or lead him to apply a non-excitatory signal.

The Examiner further cited Ben-Haim, U.S. Patent 5,443,489 against certain claims in the original claim set. The Applicant agrees with the Examiner that processing information received from the mapping step would be a routine step, **provided that the processing was known in the art**. Applicant is not claiming such mapping step *per se*, but the use of the mapping step together with the method of the invention was not known, provides enhanced possibility to exploit the invention, and is not known in the art. Therefore, Ben-Haim does not teach anything that may adversely affect the inventiveness of the present application. Once again, this is believed to be clearly pointed out in the enclosed new set of claims.

Pless et al., U.S. Patent 4,971,058, has been cited in combination with Renger et al., against original claims 130-131. It should be noted, however, that Pless et al. teaches to treat fibrillation by delivering "a high energy shock to the heart". In contrast, the present invention teaches to apply a non-excitatory signal that changes the behavior of the heart by changing its response to regular electrical signals, **not by applying a shock**. This, as will be appreciated, is a great advantage of the invention, since the shock delivered by Pless et al. is painful, and may be deleterious to the heart, while the non-excitatory signal is harmless and painless. Therefore, even if Pless et al. were relevant prior art, it would still not affect the inventive step of the present application.

Finally, Kallok, U.S. Patent 5,281,219 has been cited to deny inventive step of original claims 244 and 245. However, it should be noted that Kallok provides "stimulation pulses", as explained in Col. 1, lines 41-53, and in claim 1. Kallok cannot employ non-excitatory signals, **because its purpose is to excite**. Therefore, Kallok teaches away from the present invention.

CONCLUSION

Therefore, it is respectfully submitted that, in view of the claim amendments submitted herewith, all claims on record should be held allowable. If, however, the Examiner cannot yet fully agree to the above, it is respectfully requested that either a further Written Opinion according to rule 66.4 PCT be issued, or an informal communication under Rule 66.6 PCT be held by telephone with the undersigned Applicant's attorney, at +972-7-6497 871.

Respectfully submitted,

NEW TECHNOLOGIES (SA-YSY) LTD. ET AL.
BY:

Kfir Luzzatto
LUZZATTO & LUZZATTO
Attorney for Applicant

March 29, 1998

CLAIMS:

1. A method of modifying the activity of the heart, or of a portion thereof, comprising applying to said heart, or portion thereof a non-excitatory electric field of a magnitude, shape, duty cycle, phase, frequency and duration suitable to obtain the desired change, wherein said field is applied at a time such as to be unable to generate a propagating action potential.

2. A method according to claim 1, wherein the portion of the heart to which the non-excitatory field is applied is a heart chamber.

3. A method according to claim 1, wherein the non-excitatory electric field comprises an alternated current electric field.

4. A method according to claim 1, wherein the non-excitatory electric field has a temporal envelope selected from exponential temporal envelope, sinusoidal temporal envelope, square temporal envelope, triangular temporal envelope, ramped temporal envelope, sawtooth temporal envelope and biphasic temporal envelope.

5. A method according to claim 1, wherein the desired change is an increase of the force of contraction of said heart, heart chamber or portion thereof.

6. A method according to claim 1, wherein the desired change is an increase of the stroke volume of a chamber of the heart.

7. A method according to claim 1, wherein the desired change is an increase of the output flow of a chamber of the heart.

8. A method according to claim 1, wherein the desired change is a change in pressure.

9. A method according to claim 8, wherein the pressure is end diastolic pressure or end systolic pressure of a chamber or aortic pressure.

10. A method according to claim 1, wherein the desired change is a change of the heart rate.

11. A method according to any one of claims 1 to 10, comprising sensing the activation of a portion of the heart at a suitable location, and thereafter calculating or estimating therefrom the activation time of the portion of the heart the activity of which it is desired to modify.

12. A method according to claim 11, further comprising determining the delay at which the non-excitatory electric field is to be applied from said activation time.

13. A method according to any one of claims 1 to 12, wherein the portion of the heart the activity of which it is desired to modify comprises a plurality of sub-portions having each independently defined activations, and wherein separate non-excitatory electric fields are applied to a plurality of said sub-portions, independently or in synchronization with one another.

14. A method according to any one of claims 1 to 13, wherein the activation of the heart, the heart chamber, or of portions thereof, is obtained by pacing, and wherein the application of the non-excitatory electric field is synchronized with the pacing signal and is effected with a timing relative to the pacing signal.

15. A method according to any one of claims 1 to 13, wherein a defibrillating signal is provided to the heart, and wherein the application of the non-excitatory electric field is synchronized with said defibrillating signal.

16. A method of performing cardiac surgery comprising applying to the heart, or to a portion thereof a non-excitatory electric field of a magnitude, shape, duty cycle, phase, frequency and duration suitable to control the electro-mechanical activity of the tissue in the area on

which surgery is to be performed, wherein said field is such as to inhibit a propagating action potential, and thereafter performing the required surgical procedure on said area.

17. A method of performing cardio-vascular surgery comprising applying to the heart chamber or to a portion thereof a non-excitatory electric field of a magnitude, shape, duty cycle, phase, frequency and duration suitable to reduce the output flow, contractility, or pressure thereof, when surgery is performed on tissue perfused by the flow of said chamber, wherein said field is such as to be unable to generate a propagating action potential, and thereafter performing the required surgical procedure on said area.

18. A method of reducing an output of a chamber of a heart, comprising applying to a portion of said heart chamber a non-excitatory electric field of a magnitude, shape, duty cycle, phase, frequency and duration suitable to obtain the desired change, wherein said field is applied at a time such as to be unable to generate a propagating action potential, and wherein reducing the output of the chamber is obtained by reducing the reactivity of said portion, or its sensitivity, to an activation signal, or by reversibly blocking its conduction pathway.

19. A method of treating an abnormal activation of the heart, particularly fibrillation, comprising applying to said heart or to a portion thereof a non-excitatory electric field of a magnitude, shape and duration suitable to treat the abnormal activation condition, wherein said field is such as to be unable to generate a propagating action potential.

20. A method according to claim 1, wherein the electric field is applied at one or more of the positions selected from among the group consisting essentially of internally or externally to the heart, within a blood vessel, intramuscularly, along the normal conduction direction or perpendicularly thereto.

21. A method according to claim 1 wherein the electric field is applied using electrodes selected from unipolar electrodes or bipolar electrodes.

22. A method according to claim 11, wherein the activation is sensed by sensing a value of a parameter of an ECG, and wherein the activation time is estimated based on a delay value associated with the value of the parameter.

23. A method according to, claim 1 wherein the application of the non-excitatory field is repeated during a plurality of heart beats, and wherein said repeated application is effected by skipping the application of the field to some of the beats in a train of consecutive heart beats, and/or by reducing the frequency at which the beats are skipped is gradually reduced, and/or by changing between beats the size of the portion of the heart to which the field is applied.

24. A method of modifying the electro-mechanical activation of at least a portion of a heart, comprising mapping the activation profile of the portion, determining the desired change in the activation, and modifying the conduction velocity in a non-arrhythmic segment of the portion, wherein the non-excitatory electric field is of a magnitude, shape, duty cycle, phase, frequency and duration suitable to obtain the desired change.

25. A method of modifying the activation profile of at least a portion of a heart, comprising mapping the activation profile of said portion, determining the desired change in the activation profile and changing the refractory period of at least a segment of the portion, wherein the non-excitatory electric field is of a magnitude, shape, duty cycle, phase, frequency and duration suitable to obtain the desired change, and wherein said segment is selected from a segment that is not part of a reentry circuit or an arrhythmia focus in the heart, a segment that is a part of a reentry circuit or an arrhythmia focus in the heart, or an ischemic segment.

26. A method of modifying the activation profile of at least a portion of a heart, comprising mapping the activation profile of said portion, determining the desired change in the activation profile and reversibly blocking the activation of at least a segment of the portion, wherein the non-excitatory electric field is of a magnitude, shape, duty cycle, phase, frequency and duration suitable to obtain the desired change, and wherein said

segment is selected from a segment that is not part of a reentry circuit or an arrhythmia focus in the heart, a segment that is a part of a reentry circuit or an arrhythmia focus in the heart, or an ischemic segment.

27. A method of treating a segment of the heart which induces arrhythmias due to an abnormally low excitation threshold, comprising identifying the segment and applying thereto a desensitizing electric field such that said excitation threshold is increased to a normal range of values.

28. A method according to claim 1, wherein the change comprises selectively and reversibly increasing or reducing the contractility of one of the portions or ventricles of the heart relative to another portion or to the other ventricle.

29. A method according to claim 1, further comprising determining a desired range of values for at least one parameter of cardiac activity and controlling at least a local force of contraction of the heart to maintain said parameter within the desired range.

30. Heart control apparatus, comprising circuitry for generating a non-excitatory electric field, and electrodes for applying to a heart or to a portion thereof said non-excitatory electric field, wherein said circuitry for generating a non-excitatory electric field generate a field with a timing relative to the activation of the heart or of a portion thereof, and of a magnitude, shape, duty cycle, phase, frequency, and duration such as to be unable to generate a propagating action potential.

31. Apparatus according to claim 30, comprising means for generating an AC non-excitatory electric field.

32. Apparatus according to claim 30, comprising means for imparting to the non-excitatory electric field a temporal envelope selected from exponential temporal envelope, sinusoidal temporal envelope, square temporal envelope, triangular temporal envelope, ramped temporal envelope, sawtooth temporal envelope, and biphasic temporal envelope.

33. Apparatus according to claim 30, further comprising means for mapping the activation profile of the portion.

34. Heart control apparatus according to claim 30, wherein the electrodes are suitable to be positioned externally to the body.

35. Heart control apparatus according to claim 30, said apparatus being suitable for controlling a parameter selected from the force of contraction, heart rate, stroke volume, chamber or aortic pressure, or output flow.

36. Heart control apparatus according to claim 30, wherein the electrodes comprise at least one unipolar electrode and a housing which functions as a second electrode.

37. Apparatus according to claim 30, comprising at least two electrodes, suitable to apply said non-excitatory electric field across at least one predetermined portion of the heart.

38. Apparatus according to claim 30, comprising at least three electrodes, wherein each pair of said at least three electrodes is selectively and separately electrifiable.

39. Apparatus according to claim 30, comprising a sensor adapted to sense the activation of a portion of a heart, and field application circuitry adapted to apply said field to the electrodes as a response to activation sensed by said sensor.

40. Apparatus according to claim 39, further comprising logic circuitry to calculate the application parameters of the electric field from the activation sensed by the sensor.

41. Apparatus according to claim 40, wherein the application parameters include the delay time from the sensed activation.

42. Apparatus according to claim 39, further comprising multiple sensors that sense independently or in a combined logic.

43. Apparatus according to any one of claims 30 to 42, further comprising feedback control means to measure at least one physiological response to the electrification of the electrodes, and to modify the application parameters of the non-excitatory electric field as a result of said responses in order to maintain said responses within a predetermined range of values.

44. Apparatus according to any one of claims 30 to 43, further comprising synchronization circuitry, to synchronize the application of the non-excitatory electric field to the pacing signal generated by a pacemaker wherein the pacemaker and the remainder of the apparatus are contained in a common housing and use common electrodes.

45. Apparatus according to any one of claims 30 to 43, further comprising synchronization circuitry, to synchronize the application of the non-excitatory electric field to the defibrillating signal generated by a defibrillator wherein the defibrillator and the remainder of the apparatus are contained in a common housing and use common electrodes.

46. Cardiac surgery aiding apparatus, comprising circuitry for generating a non-excitatory electric field, and electrodes for applying to a heart or to a portion thereof said non-excitatory electric field, wherein said circuitry for generating a non-excitatory electric field generate a field of a magnitude, shape duty cycle, phase, frequency and duration suitable to control the electro-mechanical activity of the tissue in the area on which surgery is to be performed, and wherein said field is unable to generate a propagating action potential.

47. Cardio-vascular surgery aiding apparatus, comprising circuitry for generating a non-excitatory electric field, and electrodes for applying to a heart chamber or to a portion thereof said non-excitatory electric field, wherein said circuitry for generating a non-

excitatory electric field generate a field of a magnitude, shape, duty cycle, phase, frequency and duration suitable to reduce the output flow, contractility, or pressure of said chamber, when surgery is performed on tissue perfused by the flow of said chamber, and wherein said field is such as to be unable to generate a propagating action potential, and thereafter performing the required surgical procedure on said area.

48. Apparatus according to claim 33, further comprising circuitry for modifying the conduction velocity in a non-arrhythmic segment of a heart portion.

49. Apparatus according to claim 30, comprising circuitry for sensing the activation by sensing a value of a parameter of an ECG, and circuitry for estimating the activation time based on a delay value associated with the value of the parameter.

50. Apparatus according to claim 30, comprising means for electrifying the electrodes using a single signal which combines a pacing signal and a non-excitatory electric field.

51. Apparatus according to claim 30, comprising controlling means and memory means to coordinate the electrification of all the electrodes.

52. A method of modifying the activity of a heart or portion thereof, comprising providing one implantable light source which generates pulses of light, for at least 1000 cardiac cycles, over a period of less than 5000 cycles or a plurality of light sources each attached to a different site of the heart, and a wave guide for providing non-damaging intensities of light from the light source to at least one site of the heart.

53. A method of modifying the activity of the heart or a portion thereof, comprising irradiating the portion with radio frequency radiation synchronized to the activation of said heart or portion thereof, and repeating said irradiation at at least 100 cardiac cycles, during a period of less than 1000 cardiac cycles.

54. A method of controlling a heart, comprising applying a non-excitatory electric field to a first portion of a chamber of said heart, such that a force of contraction of the first portion is lessened, and applying a non-excitatory electric field to a second portion of a chamber, such that a force of contraction of the second portion is increased.

55. Apparatus for modifying the activity of a heart or portion thereof, comprising one implantable light source which generates pulses of light, for at least 1000 cardiac cycles, over a period of less than 5000 cycles or a plurality of light sources each attached to a different site of the heart, and a wave guide for providing non-damaging intensities of light from the light source to at least one site of the heart.

56. Apparatus for modifying the activity of the heart or a portion thereof, comprising means for irradiating the portion with radio frequency radiation synched to the activation, and means for repeating irradiating at at least 100 cardiac cycles, during a period of less than 1000 cardiac cycles.

57. Heart control apparatus comprising circuitry for applying a non-excitatory electric field to a first portion of a heart chamber, such that a force of contraction of the first portion is lessened, and circuitry for applying a non-excitatory electric field to a second portion of a chamber, such that a force of contraction of the second portion is increased.

58. Apparatus according to claim 30, comprising circuitry for applying separate non-excitatory electric fields, independently or in synchronization with one another, to a plurality of sub-portions of a heart, having each independently defined activations.

Applicants: New Technologies (SA-YSY), Ltd., et al.

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Title: Electrical Muscle Controller

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STATEMENT AND AMENDMENTS UNDER ARTICLE 34, PCT

This statement accompanies a new set of claims 1-246 contained on new pages 58-82/10 which replace old pages 58-82.

Claims 1, 5, 6, 9, 12, 15, 18-23, 26-32, 36, 41, 42, 44-50, 103, 105, 106, 109, 113-116, 118, 120-122, 124-126, 132, 137, 145, 152, 155, 157, 160, 161, 167, 178, 190, 193, 196, 202, 203, 229, 237, 241-243 and 246 have been amended. For the convenience of the Examiner, one "clean" copy of the new claims is attached together with a marked up copy of claims 1-246 which shows the amendments made to the claims as originally filed.

Applicants respectfully request that the preliminary examination be carried out on the attached claims.

With respect to the indications regarding patentability of the claims made in the search report, the following are the applicants' remarks:

Applicants note that the Examiner has cited U.S. Patent 4,559,947 to RENGER (the '947 patent) against many of the claims which are limited to non-excitatory electric fields. Applicants submit that the '947 patent does not disclose using non-excitatory fields on the heart, especially not fields which do not cause a propagating activation signal and which modify the reaction of the heart tissue to activation signals. In fact, the '947 patent is concerned with pacing fields which are excitatory and which, generally, reduce the force of contraction of the heart by sub-optimal activation of the heart.

In order to avoid any question as to the distinction between the non-excitatory nature of the claimed fields and those of the '947 patent, all the claims where the term "non-excitatory electrical field" appear, have been amended to more clearly define the meaning of the term. Applicants believe that this change alone will overcome any rejection of these claims based on the '947 patent.

Since the '947 patent does not teach applying a non-excitatory field for controlling the heart's operation as defined in the claims, claims which are rejected as being anticipated or obvious in view of the '947 patent, are patentable over this art. Specific

distinctions are given for each of the claims.

Claims 1-25 are indicated as being anticipated by the '947 patent.

Claim 1- Applicants submit that claim 1 as originally filed was not anticipated by the '947 patent, since the '947 patent does not disclose the application of non-excitatory fields to at least a portion of the heart chamber and certainly not one which increases the force of contraction of the portion. In fact, the '947 patent is concerned with pacing fields which are excitatory and which, generally reduce the force of contraction of the heart.

The present inventors have found, surprisingly, that a non-excitatory field can be operative to increase the force of contraction of the heart muscle.

Claims 2-4- These claims are dependent on claim 1 and are patentable for the same reasons as is claim 1. Moreover, they define an even greater increase in force than that defined by claim 1 and are thus, even further removed from the cited prior art.

Claim 5- Applicants submit that claim 5 as originally filed was not anticipated by the '947 patent, since the '947 patent does not disclose applying a non-excitatory field after activation and certainly not one within 70 msec after activation.

The present inventors have found, surprisingly, that a delayed non-excitatory field can be operative to modify the force of contraction of the heart muscle.

Claim 6- Applicants submit that claim 6, as originally filed was not anticipated by the '947 patent, since the '947 patent does not disclose applying a non-excitatory field after activation and certainly not one which increases the pressure in a chamber of the heart.

The present inventors have found, surprisingly, that a delayed non-excitatory field can be operative to increase the peak pressure in a heart chamber.

Claims 7-8- These claims are dependent on claim 6 and are patentable for the same reasons as is claim 6. Moreover, they define an even greater increase in pressure than that defined by claim 6 and are thus, even further removed from the cited prior art.

Claim 9- Applicants submit that claim 9, as originally filed, was not anticipated by the

'947 patent, since the '947 patent does not disclose applying a non-excitatory field after activation and certainly not one which increases the flow volume from a chamber of the heart.

The present inventors have found, surprisingly, that a delayed non-excitatory field can be operative to increase the flow volume from a heart chamber.

Claims 10-11- These claims are dependent on claim 9 and are patentable for the same reasons as is claim 9. Moreover, they define an even greater increase in flow volume than that defined by claim 9 and are thus, even further removed from the cited prior art.

Claim 12- Applicants submit that claim 12, as originally filed, was not anticipated by the '947 patent, since the '947 patent does not disclose applying a non-excitatory field after activation and certainly not one which increases the flow rate from a chamber of the heart.

The present inventors have found, surprisingly, that a delayed non-excitatory field can be operative to increase the flow rate from a heart chamber.

Claims 13-14- These claims are dependent on claim 12 and are patentable for the same reasons as is claim 12. Moreover, they define an even greater increase in flow rate than that defined by claim 12 and are thus, even further removed from the cited prior art.

Claim 15- Applicants submit that claim 15 as originally filed was not anticipated by the '947 patent, since the '947 patent does not disclose applying a non-excitatory field after activation and certainly not one at a duration of at least 101.

The present inventors have found, surprisingly, that a delayed non-excitatory field can be operative to modify the force of contraction of the heart muscle.

Claims 16-17- These claims are dependent on claim 15 and are patentable for the same reasons as is claim 15. Moreover, they define an even longer delay than claim 15.

Claim 18- Applicants submit that claim 18, as originally filed, was not anticipated by the '947 patent, since the '947 patent does not disclose applying a non-excitatory field after activation and certainly not one between an inner and an outer surfaces of the chamber.

Claim 19- Applicants submit that claim 19, as originally filed, was not anticipated by the '947 patent, since the '947 patent does not disclose applying a non-excitatory field after activation and certainly not one applied along an outer surface of the chamber.

Claim 20- Applicants submit that claim 20, as originally filed, was not anticipated by the '947 patent, since the '947 patent does not disclose applying a non-excitatory field after activation and certainly not one applied between an intramuscle portion and at least one of an inner and an outer surfaces of the chamber.

Claim 21- Applicants submit that claim 21, as originally filed, was not anticipated by the '947 patent, since the '947 patent does not disclose applying a non-excitatory field after activation and certainly not one applied between a single electrode and a casing of an implanted device.

Claim 22- Applicants submit that claim 22, as originally filed, was not anticipated by the '947 patent, since the '947 patent does not disclose applying a non-excitatory field after activation and certainly not one applied using an electrode floating in the heart.

Claim 23- Applicants submit that claim 23, as originally filed, was not anticipated by the '947 patent, since the '947 patent does not disclose applying a non-excitatory field after activation and certainly not one applied using two electrodes spaced apart at least 2 cm. Excitatory pacing signals are usually applied using bipolar electrodes, which have a small spacing.

Claims 24-25- These claims are dependent on claim 23 and are patentable for the same reasons as is claim 23. Moreover, they define an even greater spacing than claim 23.

Claim 26- Claim 26 is indicated as being anticipated by the '947 patent and by US patent 5,549,646 to KAYZ (the '646 patent).

Applicants submit that claim 26, as originally filed, was not anticipated by either the '947 patent or the '646 patent. The '947 patent does not disclose applying a non-excitatory field after activation and certainly not one applied using two electrodes one at an apex and one at a base of a chamber. The '646 patent does not describe the particular

electrode arrangement of claim 26. In addition, claim 26 as amended, describes using a non-excitatory field which modifies the response of the portion to an activation signal. The '646 patent teaches away from interaction between the heart and the impedance measurement which it teaches, as evidenced for example by Col. 10 lines 27-38, where it is recommended that the measurement be done either using a very low signal voltage or while the heart is refractory so that it not interfere with the heart's natural rhythm. Non-excitatory signals of the type claimed in claim 26, by their nature, modify the activation profile of the heart in a significant way.

Claim 27- This claim is indicated as being anticipated by the '646 patent.

Applicants submit that claim 26, as amended, describes using a non-excitatory field which modifies the response of the portion to an activation signal and is not anticipated by the '646 patent. The '646 patent teaches away from interaction between the heart and the impedance measurement, which it teaches, as evidenced for example by Col. 10 lines 27-38, where it is recommended that the measurement be done either using a very low signal voltage or while the heart is refractory so that it not interfere with the heart's natural rhythm. Non-excitatory signals of the type claimed in claim 26, by their nature, modify the activation profile of the heart in a significant way.

Claim 28- This claim is indicated as being anticipated by US Patent 5,184,620 to CUDAHY (the '620 patent).

Applicants submit that claim 28, as amended, describes using a non-excitatory field which modifies the response of the portion to an activation signal and is not anticipated by the '620 patent. The '620 patent does not suggest any interaction between the impedance measurement and the activation of the heart and especially not modifying the force of contraction. Applicant submits that in the art of impedance measurements, signal parameters are selected so that there will be no interaction between the impedance measurement and the activation profile of the heart.

Claims 29-44 are indicated as being anticipated by the '947 patent.

Claim 29- Applicants submit that claim 29, as originally filed, was not anticipated by the '947 patent, since the '947 patent does not disclose the application of non-excitatory fields

to at least a portion of the heart chamber and certainly not fields which at least partially cancel electro-tonic currents.

Claim 30- Applicants submit that claim 30, as originally filed, was not anticipated by the '947 patent, since the '947 patent does not disclose the application of non-excitatory fields to at least a portion of the heart chamber between two position and certainly does not disclose sensing an activation time between the two positions.

Claim 31- Applicants submit that claim 31, as originally filed, was not anticipated by the '947 patent, since the '947 patent does not disclose the application of non-excitatory fields to at least a portion of the heart chamber between two positions and certainly not sensing an activation time at one of the two positions and determining the delay based on the sensing of the activation time.

Claim 32 - Applicants submit that claim 32, as originally filed, was not anticipated by the '947 patent, since the '947 patent does not disclose the application of non-excitatory fields to at least a portion of the heart chamber between two positions and certainly not estimating an activation time at the portion utilizing a sensed activation time at a site.

Claims 33-35 - These claims are dependent on claim 32 and are patentable for the same reasons as is claim 32. Moreover, they add additional limitations. Claim 33 adds a sensing of an ECG. Claim 34 adds that the site is in a different chamber from the portion. Claim 35 adds that the site is substantially the earliest activated site in the chamber of the portion.

Claim 36- Applicants submit that claim 36, as originally filed, was not anticipated by the '947 patent, since the '947 patent does not disclose the application of non-excitatory fields to at least a portion of the heart chamber and certainly not applying two such fields to two different portions.

Claim 37 - This claim is dependent on claim 36 and is patentable for the same reasons as is claim 36. Moreover, claim 37 adds the further patentable requirement that the two fields be applied in the same cardiac cycle.

Claims 38-39 - These claims are dependent on claim 37 and are patentable for the same reasons as is claim 37. Moreover, they add additional patentable limitations. Claim 38 adds that the application of each field is synchronized to the activation time in its respective portion. Claim 39 adds that the second field has a different effect on the heart than the first field.

Claim 40 - This claim is dependent on claim 36 and is patentable for the same reasons as is claim 36. Moreover, claim 40 adds the patentable requirement that in some cycles only the second field is applied.

Claim 41- Applicants submit that claim 41, as originally filed, was not anticipated by the '947 patent, since the '947 patent does not disclose the application of non-excitatory fields to at least a portion of the heart chamber and certainly does not disclose estimating the activation at the portion and applying the field at a delay after the estimated activation.

Claim 42- Applicants submit that claim 42, as originally filed, was not anticipated by the '947 patent, since the '947 patent does not disclose the application of non-excitatory fields to at least a portion of the heart chamber and certainly not repeating the application of the field during a plurality of heart beats, some of which are not consecutive.

Claim 43- This claim is dependent on claim 42 and is patentable for at least the same reasons as is claim 42. Moreover, claim 43 adds the patentable limitation that the frequency at which heartbeats are skipped is gradually reduced.

Claim 44- Applicants submit that claim 44, as originally filed, was not anticipated by the '947 patent, since the '947 patent does not disclose the application of non-excitatory fields to at least a portion of the heart chamber and certainly does not disclose changing the extent of the portion to which the field is applied, between beats.

Claim 45- This claim is indicated as being anticipated by US patent 5,443,489 to BEN-HAIM (the '489 patent).

Applicants submit that claim 45, as originally filed, was not anticipated by the '489 patent. The '489 patent does not disclose irradiating a portion of the heart, with light,

synched to the activation of the portion and repeated at least 100 times within 1000 cardiac cycles. However, This claim has been amended to limit the light to light intensities which do not damage the portion. This type of light is certainly not disclosed or even suggested anywhere in the '489 patent.

Claim 46- This claim is indicated as being anticipated by the '489 patent.

Applicants submit that claim 46, as originally filed, was not anticipated by the '489 patent. The '489 patent does not disclose irradiating a portion of the heart, with RF radiation, synched to the activation of the portion and repeated at least 100 times within 1000 cardiac cycles. However, This claim has been amended to limit the RF to RF intensities which do not damage the portion but which do affect its response to an activation signal. This type of RF is certainly not disclosed or even suggested anywhere in the '489 patent.

Claims 47-49 are indicated as lacking an inventive step in view of the '947 patent. Applicant respectively submits that none of the cited art, teaches or makes obvious affecting the local chemistry of the heart.

Claim 47- Applicants submit that claim 47 as originally filed is not obvious in view of the '947 patent, since the '947 patent does not teach or even suggest modifying the availability of calcium ions during a period of time less than 70 msec after the activation of a portion of the heart. However, claim 47 has been amended to more clearly point out that the modification is made in response to the activation.

Claim 48- Applicants submit that claim 48 as originally filed is not obvious in view of the '947 patent, since the '947 patent does not teach or even suggest modifying the transport rate of calcium ions during a period of time less than 70 msec after the activation of a portion of the heart. However, claim 48 has been amended to more clearly point out that the modification is made in response to the activation.

Claim 49- Applicants submit that claim 49 as originally filed is not obvious in view of the '947 patent, since the '947 patent does not teach or even suggest modifying the availability of catecholamines at a portion in synchrony with the activation. However, claim 49 has

been amended to more clearly point out that the modification is made in response to the activation.

Claim 50- This claim is indicated as lacking inventive step in view of the '489 patent.

Applicants submit that claim 50, as originally filed, is not obvious in view of the '489 patent. The '489 patent does not teach using a non-excitatory field to modify the conduction velocity in a non-arrhythmic segment of a heart to achieve a desired change in activation profile.

Claim 51- This claim is indicated as lacking inventive step in view of the '947 patent.

Applicants submit that claim 51, as originally filed, is not obvious in view of the '947 patent. The '947 patent does not teach or even suggest modifying, using a non-excitatory field, the conduction velocity in a non-arrhythmic segment of a heart and certainly does not suggest thus modifying the conduction velocity of Purkinje fibers. In addition, claim 51, being dependent on claim 50, is patentable for the same reasons as claim 50.

Claims 52-102 are indicated as lacking inventive step in view of the '947 patent. All of these claims are dependent claims and applicant respectfully submits that they are all patentable at least as a result of their parent claims being patentable. In addition, all of these claims add additional limitations to the already novel and inventive parent claims as described below.

Claims 52-56 describe various types of local activation, used to synchronize the application of the non-excitatory field, in claims 1-44.

Claim 57 defines forcing an electric current through the portion of the heart. Claims 58-64 define the amplitude of this current. There is no teaching in the art of the amplitude of non-excitatory fields applied as defined in claims 1-44, from which these claims depend.

Claims 65-67 are dependent on claims 1-14 or 18-44 and define the duration of the applied fields. There is no teaching in the art of the duration of non-excitatory fields of the types defined in claims 1-14 or 18-44, from which these claims depend.

Claims 68-78 are dependent on claims 1-44 and define various limitations on the delay between the activation and the application of the field. There is no teaching in the art of the delay and timing of non-excitatory fields of the types defined in claims 1-44, from which these claims depend.

Claims 79-87 are dependent on claims 1-44 and define various temporal envelopes for the non-excitatory fields. There is no teaching in the art of the temporal envelope of non-excitatory fields of the types defined in claims 1-44, from which these claims depend.

Claim 88 is dependent on claims 1-44 and describes applying the field along an inner surface of a heart chamber. There is no teaching in the art of applying non-excitatory fields of the types defined in claims 1-44, from which these claims depend, along the inner surface of the heart.

Claims 89-90 are dependent on claims 1-44 and describe applying the field in various orientations relative to the muscle fibers in the heart muscle. There is no teaching in the art of the direction of application of non-excitatory fields of the type defined in claims 1-44, from which these claims depend.

Claims 91-94 are dependent on claims 1-22 or 29-44 and describe various inter-electrode distances for applying a non-excitatory field. There is no teaching in the art of the distances between the electrodes for applying of non-excitatory fields of the type defined in claims 1-44, from which these claims depend.

Claims 95-98 are dependent on claims 1-44 and describe various locations for the application of the non-excitatory field. There is no teaching in the art of the portions to which non-excitatory fields, as defined in claims 1-44, are to be applied.

Claims 99-101 are dependent on claims 1-44 and describe combining (excitatory) pacing with applying a non-excitatory field. There is no teaching in the art of combining excitatory pacing with the non-excitatory fields defined in claims 1-44.

Claim 102 is dependent on claims 1-29 or 36-44 and defines the addition of sensing a

specific activation at a site. There is no teaching of this feature with the application of the non-excitatory fields of claims 1-29 or 36-44.

Claims 103-104 These claims are indicated as lacking inventive step in view of the '489 patent.

Applicants submit that claim 103, as amended, is not obvious in view the '489 patent. The '489 patent does not suggest reversibly blocking the activation of a segment of the heart to achieve a desired change in activation profile. The '489 patent makes irreversible changes to achieve an activation profile. Claim 104, which is dependent on claim 103, is deemed to be patentable for at least the same reasons. Further, not even permanent blocking of the activation to an ischemic portion of the heart is taught or even suggested in the '489 patent.

Claim 105 has no art cited against it and applicant submits that it is patentable.

Claims 106-116 are indicated as being anticipated by the '947 patent.

Claim 106 - Applicants submit that claim 106, as originally filed, is not anticipated by the '947 patent, since the '947 patent does not describe applying a non-excitatory field to a pacemaker region of a heart. Applicants have amended the claim to more clearly point out that the non-excitatory field does not generate a propagating action potential and that the non-excitatory field modifies the heart rate.

Claims 107-108 - These claims are dependent on claim 106 and are patentable for at least the same reasons as is claim 106. Moreover, claim 107 adds the limitation that an action potential duration of the region is extended. Claim 108 adds the limitation the refractory period of a significant portion of the right atrium is extended. Neither of these features is taught by the '947 patent. Where the '947 patent teaches extending refractory period, the meaning is extending the time between two excitation pulses, NOT affecting the reaction of cardiac tissue. For example, see Col. 19 lines 39-46 and Col. 33 lines 31-35.

Claim 109 - Applicants submit that claim 109, as originally filed is not anticipated by the '947 patent, since the '947 patent does not teach applying a non-excitatory field, nor does

it teach purposely reducing the output of a cardiac chamber.

Claims 110-112 - These claims are dependent on claim 109 and are patentable for at least the same reasons as claim 109. Moreover, claim 110 adds the limitation that the non-excitatory field is applied prior to the activation of the portion. Claim 111 adds the limitation that the field reduces the reactivity of the portion to an activation signal. Claim 112 adds the limitation that the field reduces the sensitivity of the portion to an activation signal. None of these limitations is taught by the '947 patent.

Claim 113 - Applicants submit that claim 113, as originally filed, is not anticipated by the '947 patent, since the '947 patent does not teach determining activation and conduction pathways to a portion of a chamber, does not teach applying a non-excitatory field, and certainly does not teach reversibly blocking conduction pathways.

Claim 114 - Applicants submit that claim 114, as originally filed, is not anticipated by the '947 patent, since the '947 patent does not teach determining activation and conduction pathways to a portion of a chamber which are not part of an abnormal conduction pathway in the heart and does not teach reversibly blocking conduction pathways.

Claims 115-116 are indicated by the examiner as lacking an inventive step in view of the '489 patent. Applicant respectfully submits that claims 115 and 116, as originally filed, are non-obvious in view of the '489 patent, since the '489 patent does not teach or suggest applying a non-excitatory field which affects the electrical conduction or the sensitivity of a portion of the heart and certainly does not suggest applying the field prior to performing surgery on the heart.

Claims 117-122 are indicated as being anticipated by the '947 patent.

Claim 117 - Applicant submits that claim 117, as originally filed, is not anticipated by the '947 patent, since the '947 patent does not describe selectively reversibly increasing the contractility of one ventricle relative to the other ventricle.

Claim 118 - This claim is dependent on claim 117 and is patentable for at least the same

reasons. Moreover, claim 118 adds the limitation that the relative increase in contractility is achieved using a non-excitatory field, which is certainly not taught by the '947 patent.

Claim 119 - Applicant submits that claim 119, as originally filed is not anticipated by the '947 patent, since the '947 patent does not describe selectively reversibly decreasing the contractility of one ventricle relative to the other ventricle.

Claim 120 - This claim is dependent on claim 119 and is patentable for at least the same reasons. Moreover, claim 120 adds the limitation that the relative decrease in contractility is achieved using a non-excitatory field, which is certainly not taught by the '947 patent.

Claim 121 - Applicant submits that claim 121, as originally filed, is not anticipated by the '947 patent, since the '947 patent does not teach identifying an arrhythmia-inducing segment having a low excitation threshold and certainly does not teach using a non-excitatory field to decrease the sensitivity of such a segment.

Claim 122 - Applicant submits that claim 122, as originally filed, is not anticipated by the '947 patent, since the '947 patent does not teach changing an activation profile by reversibly blocking the conduction of activation signals across a plurality of elongate portions of the heart.

Claims 123-129 are indicated by the examiner as lacking inventive step in view of the '947 patent. Applicant submits that claims 123-129, which are dependent on claim 122, are patentable for at least the same reasons as claim 122. Moreover, claim 123 adds the further patentable distinction that the heart is segmented into a plurality of isolated segments. Claim 124, dependent on claim 123, adds the further patentable distinction that at least one of the segments contains an arrhythmia focus. Claim 125, dependent on claim 123, adds the further patentable distinction that at least one of the isolated segments does not contain an arrhythmia focus. Claim 126, now properly dependent on claim 123, adds individually pacing of at least two of the isolated segments. This limitation is not taught by the '947 patent. Claim 127, dependent on claims 122, adds limiting an activation front from traveling along abnormal pathways. The '947 patent contains no such teaching. Claims 128 and 129, dependent on claim 122 add synchronizing the conduction blocking and the

cardiac cycle. There is certainly no teaching of this limitation in the '947 patent.

Claims 130-131 are indicated as lacking inventive step in view of US Patent 4,971,058 to PLESS (the '058 patent). Claims 130 and 131 are dependent on claim 122 and are patentable for at least the same reasons as claim 122. Moreover, while applicants agree that the '058 patent describes detecting a fibrillation state of the heart, applicants respectfully submit that the '058 patent does not teach or even suggest reversibly blocking the conduction of activation signals along a plurality of elongate portions of the heart to treat such an arrhythmia.

Claims 132-143 are indicated as being anticipated by the '947 patent.

Claim 132 - Applicants submit that claim 132, as originally filed, is not anticipated by the '947 patent, since the '947 patent does not describe controlling at least a local force of contraction to maintain the parameter within range. However, the applicants have limited the claim to controlling using non-excitatory electric fields, which non-excitatory fields are not described or even suggested in the '947 patent.

Claims 133-136 - These claims are dependent on claim 132 and are patentable for at least the same reasons as claim 132. Moreover, claims 133 and 134 define additional aspects of the heart's activity to be controlled. Claims 135 and 136 add restrictions to the response time of the control. The '947 patent does not teach achieving any such effects with excitatory fields.

Claim 137 - Applicants submit that claim 137, as originally filed, is not anticipated by the '947 patent since the '947 patent does not teach using non-excitatory electric fields to control a heart and does not teach changing a characteristic of the field in response to a change in the reaction of the heart to the field.

Claims 138-141 - These claims are dependent on claim 137 and are patentable for at least the same reasons as claim 137. Moreover, these claims add various limitations to the characteristic of the field which is changed. The '947 patent does not have any teaching regarding these characteristics of non-excitatory fields.

Claims 142-143 - These claims are dependent claims and are patentable for at least the same reasons as their parent claims. Moreover, the applicants submit that the '947 does not suggest or teach any type of temporary treatment for a heart with an unhealed infarct.

Claim 144 has no art cited against it and applicants respectfully submit that it is patentable.

Claims 145-151 are indicated by the examiner as being anticipated by US patent 5,184,620 to CUDAHY (the '620 patent).

Claim 145 - Applicants submit that claim 145, as originally filed, is not anticipated by the '620 patent, since the '620 patent does not teach apparatus for applying a non-excitatory field at least 100 times in a period of 50,000 cardiac cycles (less than 2 days). However, the claim has been amended to require the non-excitatory field to change the response of at least a portion of the heart to activation signals, which is certainly not suggested in the '620 patent.

Claims 146-151 - These claims are dependent on claim 145 and are patentable for the same reason as their parent claim. In addition, these claims add further limitations to the frequency of application of the non-excitatory field, which further remove the apparatus from the cited prior art.

Claims 152-161 are indicated by the examiner as being anticipated by the '646 patent.

Claim 152 - Applicants submit that claim 152, as originally filed, is not anticipated by the '646 patent, since the '646 patent does not disclose using electrodes adapted to cover an area of more than 2 cm^2. However, the applicants have amended the claim to more precisely describe the apparatus whose protection is sought.

Claims 153-154 - These claims are dependent on claim 152 and are patentable for at least the same reason as claim 152. Moreover, these claims add additional limitations as to the size of the area covered by the electrode and which are not taught by the cited art.

Claims 155-156 - Applicant submits that claim 155, as amended, is not anticipated by the '646 patent, since, as described above, the '646 patent does not teach changing the response of a portion of the heart to activation signals using a non-excitatory pulse. Claim 156, which is dependent on claim 155, is patentable for at least the same reasons as claim 155.

Claims 157-159 - Applicant submits that claim 157, as amended, is not anticipated by the '646 patent, since, as described above, the '646 patent does not teach an apparatus which changes the response of a portion of the heart to activation signals using a non-excitatory pulse. Claims 158-159, which are dependent on claim 157, are patentable for at least the same reasons as claim 157. Moreover, these dependent claims add further limitations as to the distance between the electrodes.

Claim 160 - Applicant submits that claim 160, as amended, is not anticipated by the '646 patent, since, as described above, the '646 patent does not teach an apparatus for changing the response of a portion of the heart to activation signals using a non-excitatory pulse.

Claim 161 - Applicant submits that claim 161, as amended, is not anticipated by the '646 patent, since, as described above, the '646 patent does not teach an apparatus for changing the response of a portion of the heart to activation signals using a non-excitatory pulse. In addition, the '646 patent does not teach apparatus for sensing a local activation and synchronizing electrification to the local activation.

Claims 162-166 are indicated by the examiner as lacking inventive step in view of the '646 patent. Applicants submit that these claims are dependent on claim 161 and are patentable for at least the same reasons as their parent. Moreover, these claims add various limitations regarding the sensor of claim 161. There is no teaching in the cited art to applying a field as defined in claim 161 in response to the sensed activities defined in claims 162-164.

Claim 167 is indicated by the examiner to be anticipated by the '646 patent. Applicant submits that claim 167, as originally filed, is not anticipated by the '646 patent, since the '646 patent does not describe apparatus for electrifying elongate segments of at least a

portion the heart and certainly not using non-excitatory electric fields.

Claims 168-177 are indicated by the examiner as lacking inventive step in view of the '646 patent. Applicants submit that these claims are dependent on claim 167 and are patentable for at least the same reasons as their parent. Moreover, these claims add additional patentable subject matter. Claim 168 further limits the shape of the electrodes. Claim 169 further limits the frequency of application of the non-excitatory field. Claims 170-176 add limitations to the shape of the segments across which the fields are applied. Claim 177 add the limitations that the segments divide the heart into at least two electrically isolated segments.

Claims 178-190 are indicated by the examiner as being anticipated by the '947 patent.

Claim 178 - Applicants submit that claim 178, as originally filed, is not anticipated by the '947 patent, since the '947 patent does not describe an apparatus for applying a non-excitatory electric field to a portion of the heart and especially not to applying a field responsive to a determined activation in the portion.

Claims 179-189 - these claims are dependent claims and are patentable for at least the same reason as their parent claims. Moreover, claim 179, adds that the electrification is at a delay after the activation at one of the electrodes. Claim 180, dependent on claim 179, adds that the delay is less than 70 msec. Claim 181 adds that the field is applied before the local activation. Claims 182-184, dependent on claim 181, further define the difference in time between the application of the field and the local activation. Claim 185, dependent on claim 178, adds a sensor which senses activation. Claim 186, dependent on claim 178, adds the limitation that the activation at the portion is calculated. Claim 187, dependent on claim 186, adds a further limitation on the calculation. Claim 188, dependent on claim 178, adds a memory which associates a delay time with a characteristic of a sensed ECG. Claim 189, dependent on claim 188, adds that the characteristic is heart rate. Applicants submit that the '947 patent teaches none of these limitations with respect to non-excitatory fields.

Claim 190 - Applicants submit that claim 190, as originally filed, is not anticipated by the

'947 patent, since the '947 patent does not disclose an apparatus for maintaining a parameter of cardiac activity within a desired range, by non-excitatory electrification of electrodes.

Claims 191-192 are indicated by the examiner as lacking an inventive step in view of the '947 patent. Applicants submit that claims 191-192 are dependent on claim 190 and are patentable for at least the same reasons as claim 190. Moreover, claim 191 adds a memory containing a map of electrical activity. Claim 192 adds a memory containing a model of electrical activity in the heart. These features are not taught or obvious for use with non-excitatory fields and are also believed to be novel even for use with pacemakers.

Claim 193 is indicated as being anticipated by the '947 patent. Applicant submits that claim 193, as originally filed, is not anticipated by the '947 patent, since the '947 patent does not teach apparatus for electrifying the heart with a non-excitatory field and which includes a controller which measures a reaction of the heart to the non-excitatory electrification of the electrodes.

Claims 194-195 are indicated by the examiner as lacking inventive step in view of the '947 patent. Applicants submit that claims 194-195 are dependent on claim 193 and are patentable for at least the same reasons as claim 195. Moreover, claim 194 adds the limitation that the controller changes the electrification responsive to the measured reaction. Claim 195 adds a memory which stores the measured reaction.

Claim 196 is indicated by the examiner as being anticipated by the '646 patent. Applicants submit that claim 196, as amended, is not anticipated by the '646 patent, since the '646 patent does not describe a device including both a pacemaker and a power supply which electrifies electrodes with a non-excitatory field which changes the response of heart tissue to an activation signal.

Claims 197-200 are indicated by the examiner as lacking inventive step in view of the '646 patent. These claims are dependent on claim 196 and are patentable for at least the same reasons as claim 196. Moreover, these claims add additional limitations regarding the integration of a pacemaker and a controller using non-excitatory electrical fields.

Claim 201 is indicated by the examiner as lacking inventive step in view of the '646 patent. This claim is dependent on claim 196 and is patentable for at least the same reasons as claim 196. Moreover, claim 201 defines apparatus which combines the pacing electric field with a non-excitatory electric field. There is no hint of such a combination in any of the prior art, nor any motivation to make the combination.

Claim 202 is indicated by the examiner as being anticipated by the '646 patent. Applicants submit that claim 202, as amended, is not anticipated by the '646 patent, since the '646 patent does not describe any apparatus for changing the response of a portion of the heart to an activation signal, using non-excitatory electrical fields.

Claim 203 is indicated by the examiner as being anticipated by the '620 patent. Applicants submit that claim 203, as amended, is not anticipated by the '620 patent, since the '620 patent does not describe any apparatus for increasing the force of contraction of a portion of the heart to an activation signal, using externally applied non-excitatory electrical fields.

Claims 204-223 are indicated by the examiner as lacking inventive step in view of the '620 patent. These claims are dependent claims and are patentable for at least the same reasons as their parent claims. Moreover, claim 204, dependent on claim 203, adds an external pacemaker combined with the producer of non-excitatory fields. Claim 205, dependent on claim 203, adds an external ECG sensor to which the electrification of the electrodes is synchronized. Claims 206-209 add limitations to the duration of the electrification of the electrodes. Claim 210 adds the limitation that the electric field is applied by forcing a current between the electrodes. Claim 211 adds at least another pair of electrodes which are used to apply a non-excitatory field to a second portion of the heart. Claim 212, dependent on claim 211, adds a controller which coordinates the electrification of all the electrodes. Claims 213-216 add various limitations on the current amplitudes forced between the electrodes. Claim 217 adds that the electrodes are in contact with the heart. Claims 218-223 add various limitations on the temporal envelope of the field. Many, of these claims describe features and details which are neither taught nor suggested by the '620 patent.

Claim 224 is indicated by the examiner as being anticipated by the '489 patent. Applicants

submit that claim 224, as originally filed, is not anticipated by the '489 patent, since the '489 patent does not disclose or even suggest an implantable light source.

Claims 225-228 are indicated as lacking inventive step in view of the '489 patent. These claims are dependent on claim 224 and are patentable for at least the same reasons as claim 224. Moreover, claims 225-228 add additional limitations to the apparatus of claim 224. Most of the features added by these claims are not taught by the '489 patent and all are not obvious in the context of Claim 224. In particular, there is no teaching of the use of a plurality of light sources (claim 225), synchronous pulsing for the number of pulses defined in claim 224 or for using an activation sensor (claim 228).

Claim 229 is indicated by the examiner as being anticipated by the '947. Applicants submit that claim 229 is not anticipated by the '947, since the '947 patent does not disclose or suggest programming a controller to generate non-excitatory electrical fields, or the determining pulse parameters for such fields.

Claims 230-236 are indicated by the examiner as lacking inventive step in view of the '947 patent. These claims are dependent on claim 229 and are patentable for at least the same reasons as claim 229. Moreover, claim 230 adds determining a timing of the non-excitatory field, not taught or suggested by the '947 patent. Claim 231, dependent on claim 230, adds that the timing is relative to local activation. This too is not taught or suggested by the '947 patent. Claims 232-235, dependent on claim 230, add various limitations on the timing also not taught by the '947 patent. Claim 236, dependent on claim 229, adds that controlling the heart includes modifying its contractility. This is also not taught or suggested by the '947 patent.

Claim 237 is indicated as being anticipated by the '947 patent. Applicants submit that claim 237. As originally filed, is not anticipated by the '947 patent, since the '947 patent does not disclose any method for optimum placement of electrodes.

Claims 238-240 are indicated by the examiner as lacking inventive step in view of the '947 patent. These claims are dependent on claims 237 and are patentable for at least the same reasons as claim 237. Moreover, claim 238 adds limitations to the placement of the

activation sensor, which is not taught or suggested by the '947 patent. Claims 239 and 240 add limitations to the type of controlling for which electrode placement is optimized. This too is neither taught nor suggested by the '947 patent.

Claims 241-243 are indicated by the examiner as being anticipated by the '947 patent. Applicants submit that claims 241-243, as originally filed, are not anticipated by the '947 patent, since the '947 patent does not describe methods for determining pulse characteristics of non-excitatory fields.

Claims 244-245 are indicated by the examiner as being anticipated by US Patent 5,281,219 to KALLOK (the '219 patent). Applicants submit that claims 244-245, as originally filed, are not anticipated by the '219 patent, since the '219 patent does not teach or even suggest applying inhibitory electrical fields to nerve tissue.

Claim 246 is indicated by the examiner as being anticipated by the '947 patent. Applicants respectfully disagree. The '947 patent does not teach applying even a single non-excitatory field to a chamber of a heart to modify a force of contraction thereof, let alone two such fields.

Respectfully submitted,

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CLAIMS

1. A method of modifying the force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having a given duration, at a delay after the activation, to the portion, which causes the force of contraction of the portion to be increased by at least 5%.

2. A method according to claim 1, wherein the force is increased by at least 10%.

3. A method according to claim 1, wherein the force is increased by at least 30%.

4. A method according to claim 1, wherein the force is increased by at least 50%.

5. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having a given duration, to the portion at a delay of less than 70 msec after the activation.

6. A method of modifying the force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having a given duration, at a delay after the activation, to the portion, which causes the pressure in the chamber to be increased by at least 2%.

7. A method according to claim 6, wherein the pressure is increased by at least 10%.

8. A method according to claim 6, wherein the pressure is increased by at least 20%.

9. A method of modifying the force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having a given duration, at a delay after the activation, to the portion, wherein the chamber has a flow volume and wherein the flow volume is increased by at least 5%.

10. A method according to claim 9, wherein the volume is increased by at least 10%.

11. A method according to claim 9, wherein the volume is increased by at least 20%.

12. A method of modifying the force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having a given duration, at a delay after the activation, to the portion, wherein the chamber has a flow rate such that the flow rate is increased by at least 5%.

13. A method according to claim 12, wherein the rate is increased by at least 10%.

14. A method according to claim 12, wherein the rate is increased by at least 20%.

15. A method of modifying the force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field, which does not generate a propagating action potential and which changes the response of the portion to activation signals, to the portion at a delay after the activation, the field having a given duration of at least 101 msec and not lasting longer than the cycle length.

16. A method according to claim 15, wherein the duration is at least 120 msec.

17. A method according to claim 15, wherein the duration is at least 150 msec.

18. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having a given duration, at a delay after the activation, to the portion,

wherein the portion of the chamber has an inner surface and an outer surface and wherein the field is applied between the inner surface and the outer surface.

19. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having a given duration, at a delay after the activation, to the portion,

wherein the portion of the chamber has an inner surface and an outer surface and wherein the field is applied along the outer surface.

20. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having a given duration, at a delay after the activation, to the portion,

wherein the portion of the chamber has an inside surface, an outside surface and an intra-muscle portion and wherein the field is applied between the intra-muscle portion and at least one of the surfaces.

21. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having a given duration, at a delay after the activation, to the portion,

wherein the field is applied between a single electrode and a casing of an implanted device.

22. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having a given duration, at a delay after the activation, to the portion, using an electrode floating inside the heart.

23. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having a given duration, at a delay after the activation, to the portion,

wherein the field is applied using at least two electrodes and wherein the at least two electrodes are at least 2 cm apart.

24. A method according to claim 23, wherein the electrodes are at least 4 cm apart.

25. A method according to claim 23, wherein the electrodes are at least 9 cm apart.

26. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having a given duration, at a delay after the activation, to the portion,

wherein the field is applied using at least two electrodes and wherein one electrode of the at least two electrodes is at a base of a chamber of the heart and one electrode is at an apex of said chamber of the heart.

27. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having a given duration, at a delay after the activation, to the portion,

wherein the field is applied using at least three electrodes and wherein applying a non-excitatory field comprises:

electrifying a first pair of the at least three electrodes; and

subsequently electrifying a second pair of the at least three electrodes.

28. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having a

given duration, at a delay after the activation, to the portion, wherein the field is applied using at least two electrodes placed externally to the subject.

29. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having a given duration, at a delay after the activation, to the portion,

wherein the electric field at least partially cancels electro-tonic currents in at least the portion of the heart chamber.

30. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation;

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having a given duration, at a delay after the activation, to the portion between two positions; and

sensing an activation at a site between the two positions.

31. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation;

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having a given duration, at a delay after the activation, to the portion between two positions;

sensing an activation at a site coinciding with one of the two positions; and

determining said delay based on said sensing of the activation time.

32. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation;

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having a given duration, at a delay after the activation, to the portion between two positions;

sensing an activation at a site; and

estimating the activation of the portion from the sensed activation.

33. A method according to claim 32, wherein sensing comprises sensing a value of a parameter of an ECG and wherein estimating comprises estimating the delay based on a delay value associated with the value of the parameter.

34. A method according to claim 32, wherein the site is at a different chamber of the heart than the chamber at which the field is applied.

35. A method according to claim 32, wherein the site is substantially the earliest activated site in the chamber of the portion.

36. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation;

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having a given duration, at a delay after the activation, to the portion; and

applying a second non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals to a second portion of the chamber.

37. A method according to claim 36, wherein the second field is applied in the same cardiac cycle as the non-excitatory field.

38. A method according to claim 37, wherein each portion has an individual activation to which the applications of the field thereat are synchronized.

39. A method according to claim 37, wherein the second field has a different effect on the heart than the non-excitatory field.

40. A method according to claim 36, wherein only the second non-excitatory field is applied during a different cardiac cycle.

41. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation;

estimating the activation at the portion; and

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having a given duration, at a delay after the estimated activation, to the portion.

42. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation;

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having a given duration, at a delay after the activation, to the portion; and

repeating application of the non-excitatory field, during a plurality of later heart beats, at least some of which are not consecutive.

43. A method according to claim 42, comprising gradually reducing the frequency at which beats are skipped during the repeated application.

44. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation;

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having a given duration, at a delay after the activation, to the portion, wherein the portion has an extent; and

changing the extent of the portion to which the field is applied, between beats.

45. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation;

irradiating the portion with light synched to the activation, said light having an intensity which does not damage said portion; and

repeating the irradiating at at least 100 cardiac cycles, during a period of less than 1000 cardiac cycles.

46. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation;

irradiating the portion with radio frequency radiation synched to the activation, wherein said radiation does not generate a propagating action potential and wherein said radiation

changes the response of the portion to an activation signal and wherein said radiation does not cause damage to said portion; and

repeating the irradiating at at least 100 cardiac cycles, during a period of less than 1000 cardiac cycles.

47. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

modifying the availability of calcium ions inside muscle fibers of the portion, to the activation, during a period of time including a time less than 70 msec after the activation, said modification of availability being made in response to the activation.

48. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

modifying the transport rate of calcium ions inside muscle fibers of the portion, during a period of time less than 70 msec after the activation, said modification of transport rate being made in response to the activation.

49. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

modifying the availability of catecholamines at the portion in synchrony with the activation, said modification of availability being made in response to the activation.

50. A method of modifying the activation profile of at least a portion of a heart, comprising,

mapping the activation profile of the portion;

determining a desired change in the activation profile; and

modifying, using a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals, the conduction velocity in a non-arrhythmic segment of the portion, to achieve the desired change.

51. A method according to claim 50, wherein the desired change is an AV interval and wherein modifying comprises modifying the conduction velocities of purkinje fibers between an AV node and at least one of the ventricles in the heart.

52. A method in accordance with any of claims 1-44, wherein the activation comprises an average activation of the portion.

53. A method according to any of claims 1-44, wherein the activation comprises an earliest activation.

54. A method according to any of claims 1-44, wherein the activation comprises a mechanical activation.

55. A method according to any of claims 1-44, wherein the activation comprises an electrical activation.

56. A method in accordance with any of claims 1-44, wherein the portion comprises a plurality of subportions, each having an individual activation and wherein applying a field comprises applying a field to each subportion at a delay relative to the individual activation of the subportion.

57. A method in accordance with any of claims 1-44, wherein applying a non-excitatory electric field comprises driving an electric current through the segment.

58. A method in accordance with claim 57, wherein the current is less than 20 mA.

59. A method in accordance with claim 57, wherein the current is less than 8 mA.

60. A method in accordance with claim 57, wherein the current is less than 5 mA.

61. A method in accordance with claim 57, wherein the current is less than 3 mA.

62. A method in accordance with claim 57, wherein the current is at least .5 mA.

63. A method in accordance with claim 57, wherein the current is at least 1 mA.

64. A method in accordance with claim 57, wherein the current is at least 3 mA.

65. A method in accordance with any of claims 1-14 or 18-44, wherein the field is applied for a duration of between 10 and 140 msec.

66. A method in accordance with any of claims 1-14 or 18-44, wherein the field is applied for a duration of between 30 and 100 msec.

67. A method in accordance with any of claims 1-14 or 18-44, wherein the field is applied for a duration of between 60 and 90 msec.

68. A method according to any of claims 1-4 or 6-44, wherein the delay is less than 70 msec.

69. A method according to any of claims 1-44, wherein the delay is less than 40 msec.

70. A method according to any of claims 1-44, wherein the delay is less than 20 msec.

71. A method according to any of claims 1-44, wherein the delay is less than 5 msec.

72. A method according to any of claims 1-44, wherein the delay is less than 1 msec.

73. A method according to any of claims 1-44, wherein the delay is substantially zero.

74. A method according to any of claims 1-44, wherein the delay is at least 1 msec.

75. A method according to any of claims 1-44, wherein the delay is at least 3 msec.

76. A method according to any of claims 1-44, wherein the delay is at least 7 msec.

77. A method according to any of claims 1-44, wherein the delay is at least 15 msec.

78. A method according to any of claims 1-44, wherein the delay is at least 30 msec.

79. A method according to any of claims 1-44, wherein the electric field has an exponential temporal envelope.

80. A method according to any of claims 1-44, wherein the electric field has a square temporal envelope.

81. A method according to any of claims 1-44, wherein the electric field has a triangular temporal envelope.

82. A method according to any of claims 1-44, wherein the electric field has a ramped temporal envelope.

83. A method according to any of claims 1-44, wherein the electric field has a biphasic temporal envelope.

84. A method according to any of claims 1-44, wherein the electric field comprises an AC electric field.

85. A method according to claim 84, wherein the electric field has a sinusoidal temporal envelope.

86. A method according to claim 84, wherein the electric field has a sawtooth temporal envelope.

87. A method according to claim 84, wherein the electric field has a square-wave temporal envelope.

88. A method according to any of claims 1-44, wherein the portion of the chamber has an inside surface and an outside surface, wherein the field is applied along the inner surface.

89. A method according to any of claims 1-44, wherein the portion of the chamber has a normal conduction direction, wherein the field is applied along the normal conduction direction.

90. A method according to any of claims 1-44, wherein the portion of the chamber has a normal conduction direction, wherein the field is applied perpendicular to the normal conduction direction.

91. A method according to any of claims 1-22 or 29-44, wherein the field is applied between at least two electrodes.

92. A method according to claim 91, wherein the electrodes are at least 2 cm apart.

93. A method according to claim 91, wherein the electrodes are at least 4 cm apart.

94. A method according to claim 91, wherein the electrodes are at least 9 cm apart.

95. A method according to any of claims 1-44, wherein the chamber is the left ventricle.

96. A method according to any of claims 1-44, wherein the chamber is the left atrium.

97. A method according to any of claims 1-44, wherein the chamber is the right ventricle.

98. A method according to any of claims 1-44, wherein the chamber is the right atrium.

99. A method according to any of claims 1-44 and comprising pacing the heart.

100. A method according to claim 99, wherein applying the electric field is synchronized with the pacing.

101. A method according to claim 99, comprising calculating the delay based on the pacing.

102. A method according to any of claims 1-29 or 36-44, comprising sensing a specific activation at a site.

103. A method of modifying the activation profile of at least a portion of a heart, comprising,

mapping the activation profile of the portion;

determining a desired change in the activation profile; and

reversibly blocking the activation of at least a segment of the portion, to achieve the desired change, wherein the segment is not part of a reentry circuit or an arrhythmia focus in the heart.

104. A method according to claim 103, wherein the blocked segment is an ischemic segment.

105. A method of modifying the activation profile of at least a portion of a heart, comprising,

mapping the activation profile of the portion;

determining a desired change in the activation profile; and

changing the refractory period of at least a segment of the portion, to achieve the desired change, wherein the segment is not part of a reentry circuit or an arrhythmia focus in the heart.

106. A method of modifying the heart rate of a heart, comprising:

providing a subject having a heart with an active natural pacemaker region; and

applying a non-excitatory electric field, which does not generate a propagating action potential, to the region, effective to modify the heart rate.

107. A method according to claim 106, wherein the electric field extends a duration of an action potential of the region.

108. A method according to claim 106, comprising, extending the refractory period of a significant portion of the right atrium.

109. A method of reducing an output of a chamber of a heart, comprising:

determining the earliest activation of at least a portion of the chamber, which portion is not part of an abnormal conduction pathway in the heart; and

applying a non-excitatory electric field, which does not generate a propagating action potential, to the portion, effective to reduce the output of the chamber.

110. A method according to claim 109, wherein the field is applied prior to activation of the portion.

111. A method according to claim 109, wherein the field reduces the reactivity of the portion to an activation signal.

112. A method according to claim 109, wherein the field reduces the sensitivity of the portion to an activation signal.

113. A method of reducing an output of a chamber of a heart, comprising:

determining an activation of and conduction pathways to at least a portion of the chamber; and

reversibly blocking the conduction pathways, using a locally applied non-excitatory electric field which does not generate a propagating action potential.

114. A method of reducing an output of a chamber of a heart, comprising:

determining an activation of and a conduction pathway to at least a portion of the chamber, which portion is not part of an abnormal conduction pathway in the heart; and

reversibly reducing the conduction velocity in the conduction pathway, using a locally applied non-excitatory electric field which does not generate a propagating action potential.

115. A method of performing cardiac surgery, comprising:

reversibly blocking the electrical activity to at least a portion of the heart using a non-excitatory electric field which does not generate a propagating action potential; and

performing a surgical procedure on the portion.

116. A method of performing cardiac surgery, comprising:

reversibly reducing the sensitivity to an activation signal of at least a portion of the heart using a non-excitatory electric field which does not generate a propagating action potential; and

performing a surgical procedure on the portion.

117. A method of controlling the heart, comprising,

providing a subject having a heart with a left ventricle and a right ventricle;

selectively reversibly increasing the contractility of one of the ventricles relative to the other ventricle.

118. A method according to claim 117, wherein selectively reversibly increasing comprises applying a non-excitatory electric field, which does not generate a propagating action potential and which changes the response of the portion to activation signals, to at least a portion of the one ventricle.

119. A method of controlling the heart, comprising,

providing a subject having a heart with a left ventricle and a right ventricle;

selectively reversibly reducing the contractility of one of the ventricles, relative to the other ventricle.

120. A method according to claim 119, wherein selectively reversibly reducing comprises applying a non-excitatory electric field, which does not generate a propagating action potential and which changes the response of the portion to activation signals, to at least a portion of the one ventricle.

121. A method of treating a segment of a heart which induces arrhythmias due to an abnormally low excitation threshold, comprising:

identifying the segment; and

applying a desensitizing electric field, which does not generate a propagating action potential, to the segment, such that the excitation threshold is increased to a normal range of values.

122. A method of modifying an activation profile of at least a portion of a heart, comprising:

determining a desired change in the activation profile; and

reversibly blocking the conduction of activation signals across a plurality of elongate portions of the heart to achieve the desired change.

123. A method according to claim 122, wherein blocking the conduction creates a plurality of segments, isolated from external activation, in the portion of the heart.

124. A method according to claim 123, wherein at least one of the isolated segments contains an arrhythmia focus.

125. A method according to claim 123, wherein at least one of the isolated segments does not contain an arrhythmia focus.

126. A method according to claim 123, comprising individually pacing each of at least two of the plurality of isolated segments.

127. A method according to claim 122, wherein blocking the conduction limits an activation front from traveling along abnormal pathways.

128. A method according to claim 122, wherein reversibly blocking comprises reversibly blocking conduction of activation signals, synchronized with a cardiac cycle, to block abnormal activation signals.

129. A method according to claim 122, wherein reversibly blocking comprises reversibly blocking conduction of activation signals, synchronized with a cardiac cycle, to pass normal activation signals.

130. A method of treating abnormal activation of the heart, comprising:

detecting an abnormal activation state; and

modifying the activation of the heart in accordance with any of claims 122-129 to stop the abnormal activation condition.

131. A method according to claim 130, wherein the abnormal condition is fibrillation.

132. A method of controlling the heart comprising:

determining a desired range of values for at least one parameter of cardiac activity; and

controlling at least a local force of contraction in the heart, by applying a non-excitatory electric field, which does not generate a propagating action potential and which changes the response of at least a portion of the heart to activation signals, to the heart, to maintain the parameter within the desired range.

133. A method according to claim 132, wherein controlling includes controlling the heart rate.

134. A method according to claim 132, wherein controlling includes controlling a local conduction velocity.

135. A method according to claim 132, wherein the parameter responds to the control with a time constant of less than 10 minutes.

136. A method according to claim 132, wherein the parameter responds to the control with a time constant of over one day.

137. A method of controlling the heart, comprising:

determining a desired range of values for at least one parameter of cardiac activity;

controlling at least a portion of the heart using a non-excitatory electric field, which does not generate a propagating action potential and which changes the response of the portion to activation signals and having at least one characteristic, to maintain the parameter within the desired range; and

changing the at least one characteristic in response to a reduction in a reaction of the heart to the electric field.

138. A method according to claim 137, wherein the characteristic comprises a strength of the electric field.

139. A method according to claim 137, wherein the characteristic comprises a duration of the electric field.

140. A method according to claim 137, wherein the characteristic comprises a frequency of the field.

141. A method according to claim 137, wherein the characteristic comprises a waveform of the field.

142. A method of treating a patient having a heart with an unhealed infarct, comprising, applying the method of any of claims 1-50, 103-129 or 132-141, until the infarct is healed.

143. A method of treating a patient having a heart, comprising,

providing a patient, having an unhealed infarct in the heart; and

applying the method of any of claims 1-50, 103-129 or 132-141, until the heart is stabilized.

144. A method according to any of claims 1-50, 103-129 or 132-141, wherein applying a non-excitatory field comprises applying a non-excitatory field for between 3 and 5000 heart beats.

145. Apparatus for controlling a heart comprising:

a plurality of electrodes adapted to apply an electric field, which does not generate a propagating action potential and which changes the response of at least a portion of the heart to activation signals, across the portion of the heart; and

a power supply which electrifies the electrodes with a non-excitatory electric field, for a given duration at least 100 times during a period of less than 50,000 cardiac cycles.

146. Apparatus according to claim 145, wherein the electrodes are electrified at least 1000 times during a period of less than 50,000 cardiac cycles.

147. Apparatus according to claim 145, wherein the electrodes are electrified at least 1000 times during a period of less than 20,000 cardiac cycles.

148. Apparatus according to claim 145, wherein the electrodes are electrified at least 1000 times during a period of less than 5,000 cardiac cycles.

149. Apparatus according to claim 145, wherein the field is applied less than 10 times in one second.

150. Apparatus according to claim 145, wherein the power supply electrifies the electrodes at least 2000 times over the period.

151. Apparatus according to claim 145, wherein the power supply electrifies the electrodes at least 4000 times over the period.

152. Apparatus for controlling a heart comprising:

a plurality of electrodes adapted to contact the heart and adapted to apply an electric field across at least a portion of the heart; and

a power supply which electrifies the electrodes with a non-excitatory electric field, which does not generate a propagating action potential and which changes the response of the portion to activation signals, for a given duration,

wherein at least one of the electrodes is adapted to cover an area of the heart larger than 2 cm^2.

153. Apparatus according to claim 152, wherein at least one of the electrodes is adapted to cover an area of the heart larger than 6 cm^2.

154. Apparatus according to claim 152, wherein at least one of the electrodes is adapted to cover an area of the heart larger than 9 cm^2.

155. Apparatus for controlling a heart comprising:

at least one unipolar electrode adapted to apply an electric field to at least a portion of the heart; and

a power supply which electrifies the electrodes with a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals.

156. Apparatus according to claim 155, comprising a housing, which is electrified as a second electrode.

157. Apparatus for controlling a heart comprising:

a plurality of electrodes adapted to contact the heart and adapted to apply an electric field across only a portion of the heart; and

a power supply which electrifies the electrodes with a non-excitatory electric field, which does not generate a propagating action potential and which changes the response of the portion to activation signals, for a given duration,

wherein the distance between the electrodes is at least 2 cm.

158. Apparatus according to claim 157, wherein the distance is at least 4 cm.

159. Apparatus according to claim 157, wherein the distance is at least 9 cm.

160. Apparatus for controlling a heart comprising:

at least three electrodes adapted to apply an electric field across at least a portion of the heart; and

a power supply which electrifies the electrodes with a non-excitatory electric field, which does not generate a propagating action potential and which changes the response of the portion to activation signals, for a given duration,

wherein the electrodes are selectively electrifiable in at least a first configuration where two electrodes are electrified and in a second configuration where two electrodes, not both identical with the first configuration electrodes, are electrified.

161. Apparatus for controlling a heart comprising:

a plurality of electrodes adapted to apply an electric field across at least a portion of the heart;

a sensor which senses a local activation; and

a power supply which electrifies the electrodes with a non-excitatory electric field, which does not generate a propagating action potential and which changes the response of the portion to activation signals, for a given duration, responsive to the sensed local activation.

162. Apparatus according to claim 161, wherein the sensor senses a mechanical activity of the portion.

163. Apparatus according to claim 161, wherein the sensor is adapted to sense the activation at at least one of the electrodes.

164. Apparatus according to claim 161, wherein the sensor is adapted to sense the activation in the right atrium.

165. Apparatus according to claim 161, wherein the sensor is adapted to sense the activation between the electrodes.

166. Apparatus according to claim 161, wherein the sensor senses an earliest activation in a chamber of the heart including the portion and wherein the power supply times the electrification responsive to the earliest activation.

167. Apparatus for controlling a heart comprising:

electrodes adapted to apply an electric field across elongate segments of at least a portion of the heart; and

a power supply which electrifies the electrodes with a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals.

168. Apparatus according to claim 167, wherein the electrodes are elongate electrodes.

169. Apparatus according to claim 167, wherein the power supply electrifies the electrodes for a given duration of at least 20 msec, at least 1000 times over a period of less than 5000 cardiac cycles.

170. Apparatus according to claim 167, wherein the elongate segments are at least 1 cm long.

171. Apparatus according to claim 167, wherein the elongate segments are at least 2 cm long.

172. Apparatus according to claim 167, wherein the elongate segments are at least 4 cm long.

173. Apparatus according to claim 167, wherein the elongate segments are less than 2 cm wide.

174. Apparatus according to claim 167, wherein the elongate segments are less than 1 cm wide.

175. Apparatus according to claim 167, wherein the elongate segments are less than 0.5 cm wide.

176. Apparatus according to claim 167, wherein the elongate segments are less than 0.3 cm wide.

177. Apparatus according to claim 167, wherein the elongate segments divide the heart into at least two electrically isolated segments in the heart.

178. Apparatus for controlling a heart comprising:

a plurality of electrodes adapted to apply an electric field across at least a portion of the heart;

a power supply which electrifies the electrodes with a non-excitatory electric field, which does not generate a propagating action potential and which changes the response of the portion to activation signals, for a given duration; and

a circuit for determining an activation at a site in the portion,

wherein the power supply electrifies the electrodes responsive to the determined activation.

179. Apparatus according to any of claims 161-166 or 178, wherein the electric field is applied at a given delay after an activation at one of the electrodes.

180. Apparatus according to claim 179, wherein the delay is less than 70 msec.

181. Apparatus according to any of claims 161-166 or 178, wherein the electric field is applied before an activation at one of the electrodes.

182. Apparatus according to claim 181, wherein the field is applied more than 30 msec before the activation.

183. Apparatus according to claim 181, wherein the field is applied more than 50 msec before the activation.

184. Apparatus according to claim 181, wherein the field is applied more than 80 msec before the activation.

185. Apparatus according to claim 178, wherein the circuit comprises an activation sensor which senses the activation.

186. Apparatus according to claim 178, wherein the activation is calculated.

187. Apparatus according to claim 186, wherein the activation is calculated based on an activation in a chamber of the heart different from a chamber including the portion.

188. Apparatus according to claim 178, comprising a memory which stores values used to calculate a delay time, associated with a value of at least a parameter of a sensed ECG.

189. Apparatus according to claim 188, wherein the parameter comprises a heart rate.

190. Apparatus for controlling a heart comprising:

a plurality of electrodes adapted to apply an electric field across only a portion of the heart;

a power supply which electrifies the electrodes with a non-excitatory electric field, which does not generate a propagating action potential and which changes the response of the portion to activation signals, for a given duration;

a sensor which measures a parameter of cardiac activity; and

a controller which controls the electrification of the electrodes to maintain the parameter within a range of values.

191. Apparatus according to claim 190, comprising a memory which stores a map of electrical activity in the heart, wherein the controller uses the map to determine a desired electrification.

192. Apparatus according to claim 190, comprising a memory which stores a model of electrical activity in the heart, wherein the controller uses the model to determine a desired electrification.

193. Apparatus for controlling a heart comprising:

a plurality of electrodes adapted to apply an electric field across only a portion of the heart;

a power supply which electrifies the electrodes with a non-excitatory electric field, which does not generate a propagating action potential and which changes the response of the portion to activation signals, for a given duration; and

a controller which measures a reaction of the heart to the electrification of the electrodes.

194. Apparatus according to claim 193, wherein the controller changes the electrification based on the measured reaction.

195. Apparatus according to claim 193, comprising a memory which stores the measured reaction.

196. Apparatus for controlling a heart comprising:

a plurality of electrodes adapted to apply an electric field across at least a portion of the heart;

a power supply which electrifies the electrodes with a non-excitatory electric field, which does not generate a propagating action potential and which changes the response of the portion to activation signals, for a given duration; and

a pacemaker which paces the heart.

197. Apparatus according to claim 196, wherein the pacemaker and the remainder of the apparatus are contained in a common housing.

198. Apparatus according to claim 196, wherein the pacemaker and the remainder of the apparatus utilize common excitation electrodes.

199. Apparatus according to claim 196, wherein and the pacemaker and the remainder of the apparatus utilize a common power supply.

200. Apparatus according to claim 196, wherein the non-excitatory field is synchronized to the pacemaker.

201. Apparatus according to claim 198, wherein the electrodes are electrified using a single pulse which combines a pacing electric field and a non-excitatory electric field.

202. Apparatus for controlling a heart comprising:

a plurality of electrodes adapted to apply an electric field across at least a portion of the heart; and

a power supply which electrifies the electrodes with a non-excitatory electric field, which does not generate a propagating action potential and which changes the response of the portion to activation signals, for a given duration,

wherein at least one of the electrodes is mounted on a catheter.

203. Apparatus for controlling a heart comprising:

a plurality of electrodes adapted to apply an electric field across at least a portion of the heart; and

a power supply which electrifies the electrodes with a non-excitatory electric field, which does not generate a propagating action potential and which increases the force of contraction of the portion, for a given duration,

wherein the electrodes are adapted to be applied externally to the body.

204. Apparatus according to claim 203, comprising an external pacémaker.

205. Apparatus according to claim 203, comprising an ECG sensor, to which electrification of the electrodes is synchronized.

206. Apparatus according to any of claims 145-178 or 185-205, wherein the duration is at least 20 msec.

207. Apparatus according to any of claims 145-178 or 185-205, wherein the duration is at least 40 msec.

208. Apparatus according to any of claims 145-178 or 185-205, wherein the duration is at least 80 msec.

209. Apparatus according to any of claims 145-178 or 185-205, wherein the duration is at least 120 msec.

210. Apparatus according to any of claims 145-178 or 185-205, wherein a current is forced through the portion, between the electrodes.

211. Apparatus according to any of claims 145-178 or 185-205, comprising at least another two electrodes, electrified by the power supply and adapted to apply a non-excitatory

electric field, which does not generate a propagating action potential and which changes the response of a second portion to activation signals, across the second portion of the heart.

212. Apparatus according to claim 211, comprising a controller which coordinates the electrification of all the electrodes in the apparatus.

213. Apparatus according to any of claims 145-178 or 185-205, wherein a peak current through the electrodes is less than 20 mA.

214. Apparatus according to any of claims 145-178 or 185-205, wherein a peak current through the electrodes is less than 10 mA.

215. Apparatus according to any of claims 145-178 or 185-205, wherein a peak current through the electrodes is less than 5 mA.

216. Apparatus according to any of claims 145-178 or 185-205, wherein a peak current through the electrodes is less than 2 mA.

217. Apparatus according to any of claims 145-178 or 185-205, wherein the electrodes are substantially in contact with the heart.

218. Apparatus according to any of claims 145-178 or 185-205, wherein the electric field has an exponential envelope.

219. Apparatus according to any of claims 145-178 or 185-205, wherein the electric field has an triangular envelope.

220. Apparatus according to any of claims 145-178 or 185-205, wherein the electric field has an square wave envelope.

221. Apparatus according to any of claims 145-178 or 185-205, wherein the electric field is unipolar.

222. Apparatus according to any of claims 145-178 or 185-205, wherein the electric field is bipolar.

223. Apparatus according to any of claims 145-178 or 185-205, wherein the electric field has a constant strength.

224. Apparatus for optical control of a heart, comprising:

at least one implantable light source which generates pulses of light, for at least 1000 cardiac cycles, over a period of less than 5000 cycles; and

at least one wave guide for providing non-damaging intensities of light from the light source to at least one site on the heart.

225. Apparatus according to claim 224, wherein the at least one light source comprises a plurality of light sources, each attached to a different site on the heart.

226. Apparatus according to claim 224, wherein the wave guide is an optical fiber.

227. Apparatus according to any of claims 224-226, wherein the light source comprises a monochrome light source.

228. Apparatus according to any of claims 224-226, comprising a sensor, which measures an activation of at least portion of the heart, wherein the light source provides pulsed light in synchrony with the measured activation.

229. A method of programming a programmable controller for a subject having a heart, comprising:

determining pulse parameters suitable for controlling the heart using non-excitatory electric fields which do not generate a propagating action potential and which change the response of at least a portion of the heart to activation signals; and

programming the controller with the pulse parameters.

230. A method according to claim 229, wherein determining pulse parameters comprises determining a timing of the pulse relative to a cardiac activity.

231. A method according to claim 230, wherein the cardiac activity is a local activation.

232. A method according to claim 230, wherein determining a timing comprises determining timing which does not induce fibrillation in the heart.

233. A method according to claim 230, wherein determining a timing comprises determining a timing which does not induce an arrhythmia in the heart.

234. A method according to any of claims 230-233, wherein determining a timing comprises determining the timing based on a map of an activation profile of the heart.

235. A method according to any of claims 230-233, wherein determining a timing comprises calculating a delay time relative to a sensed activation.

236. A method according to any of claims 229-233, wherein controlling the heart comprises modifying the contractility of the heart.

237. A method of determining an optimal placement of at least two individual electrodes for controlling a heart using non-excitatory electric fields, comprising:

determining an activation profile of at least a portion of the heart; and

determining an optimal placement of the electrodes in the portion based on the activation profile, such that applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals, will effect a desired change in the activation profile.

238. A method according to claim 237, comprising determining an optimal location for an activation sensor, relative to the placement of the electrodes.

239. A method according to any of claims 237-238, wherein controlling comprises modifying the contractility.

240. A method according to any of claims 237-238, wherein controlling comprises creating elongate non-conducting segments in the heart.

241. A method of determining a timing parameter for a non-excitatory, repeatedly applied pulse for a heart, comprising:

applying a non-excitatory pulse, which does not generate a propagating action potential and which changes the response of at least a portion of the heart to activation signals, using a first delay;

determining if the pulse induces an abnormal activation profile in the heart; and

repeating applying a non-excitatory pulse, which does not generate a propagating action potential and which changes the response of the portion to activation signals, using a second delay, shorter than the first, if the pulse did not induce abnormal activation in the heart.

242. A method of determining a timing parameter for a non-excitatory, repeatedly applied pulse for a heart, comprising:

applying a non-excitatory pulse, which does not generate a propagating action potential and which changes the response of at least a portion of the heart to activation signals, using a first delay;

determining if the pulse induces an abnormal activation profile in the heart; and

repeating applying a non-excitatory pulse, which does not generate a propagating action potential and which changes the response of the portion to activation signals, using a second delay, longer than the first, if the pulse did not induce abnormal activation in the heart.

243. A method of programming a programmable controller for a heart, comprising:

controlling the heart using plurality of non-excitatory electric field sequences, which does not generate a propagating action potential and which change the response of at least a portion of the heart to activation signals;

determining a response of the heart to each of the sequences; and

programming the controller responsive to the response of the heart to the non-excitatory sequences.

244. A method of controlling an epileptic seizure, comprising:

detecting an epileptic seizure in brain tissue; and

applying a non-excitatory electric field to the brain tissue to attenuate conduction of a signal in the tissue.

245. A method of controlling nervous signals in periphery nerves, comprising,

selecting a nerve; and

applying a non-excitatory electric field to the nerve to attenuate conduction of nervous signals in the nerve.

246. A method of controlling a heart having a chamber comprising:

applying a non-excitatory electric field, which does not generate a propagating action potential and which changes the response of at least a first portion of a chamber to activation signals, to the first portion, such that a force of contraction of the first portion is lessened; and

applying a second non-excitatory electric field, which does not generate a propagating action potential and which changes the response of a second portion of the chamber to activation signals, to the second portion, such that a force of contraction of the second portion is increased.

CLAIMS

1. A method of modifying the force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having~~having~~ a given duration, at a delay after the activation, to the portion, which causes the force of contraction of the portion to be increased by at least 5%.

2. A method according to claim 1, wherein the force is increased by at least 10%.

3. A method according to claim 1, wherein the force is increased by at least 30%.

4. A method according to claim 1, wherein the force is increased by at least 50%.

5. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having~~having~~ a given duration, to the portion at a delay of less than 70 msec after the activation.

6. A method of modifying the force of contraction of at least a portion of a heart chamber,

comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having~~having~~ a given duration, at a delay after the activation, to the portion, which causes the pressure in the chamber to be increased by at least 2%.

7. A method according to claim 6, wherein the pressure is increased by at least 10%.

8. A method according to claim 6, wherein the pressure is increased by at least 20%.

9. A method of modifying the force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having~~having~~ a given duration, at a delay after the activation, to the portion, wherein the chamber has a flow volume and wherein the flow volume is increased by at least 5%.

10. A method according to claim 9, wherein the volume is increased by at least 10%.

11. A method according to claim 9, wherein the volume is increased by at least 20%.

12. A method of modifying the force of contraction of at least a portion of a heart chamber,

comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having~~having~~ a given duration, at a delay after the activation, to the portion, wherein the chamber has a flow rate such that the flow rate is increased by at least 5%.

13. A method according to claim 12, wherein the rate is increased by at least 10%.

14. A method according to claim 12, wherein the rate is increased by at least 20%.

15. A method of modifying the force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field, which does not generate a propagating action potential and which changes the response of the portion to activation signals, to the portion at a delay after the activation, the field having a given duration of at least 101 msec and not lasting longer than the cycle length.

16. A method according to claim 15, wherein the duration is at least 120 msec.

17. A method according to claim 15, wherein the duration is at least 150 msec.

18. A method of modifying a force of contraction of at least a portion of a heart chamber,

comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having~~having~~ a given duration, at a delay after the activation, to the portion,

wherein the portion of the chamber has an inner surface and an outer surface and wherein the field is applied between the inner surface and the outer surface.

19. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having~~having~~ a given duration, at a delay after the activation, to the portion,

wherein the portion of the chamber has an inner surface and an outer surface and wherein the field is applied along the outer surface.

20. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having~~having~~ a given duration, at a delay after the activation, to the portion,

wherein the portion of the chamber has an inside surface, an outside surface and an intra-muscle portion and wherein the field is applied between the intra-muscle portion and at least one of the surfaces.

21. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having~~having~~ a given duration, at a delay after the activation, to the portion,

wherein the field is applied between a single electrode and a casing of an implanted device.

22. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having~~having~~ a given duration, at a delay after the activation, to the portion, using an electrode floating inside the heart.

23. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation;

and

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having~~having~~ a given duration, at a delay after the activation, to the portion,

wherein the field is applied using at least two electrodes and wherein the at least two electrodes are at least 2 cm apart.

24. A method according to claim 23, wherein the electrodes are at least 4 cm apart.

25. A method according to claim 23, wherein the electrodes are at least 9 cm apart.

26. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having~~having~~ a given duration, at a delay after the activation, to the portion,

wherein the field is applied using at least two electrodes and wherein one electrode of the at least two electrodes is at a base of a chamber of the heart and one electrode is at an apex of ~~said~~ chamber of the heart.

27. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field which does not generate a propagating action

potential and which changes the response of the portion to activation signals and having~~having~~ a given duration, at a delay after the activation, to the portion,

wherein the field is applied using at least three electrodes and wherein applying a non-excitatory field comprises:

electrifying a first pair of the at least three electrodes; and

subsequently electrifying a second pair of the at least three electrodes.

28. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having~~having~~ a given duration, at a delay after the activation, to the portion, wherein the field is applied using at least two electrodes placed externally to the subject.

29. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having~~having~~ a given duration, at a delay after the activation, to the portion,

wherein the electric field at least partially cancels electro-tonic currents in at least the portion of the heart chamber.

30. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation;

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having~~having~~ a given duration, at a delay after the activation, to the portion between two positions; and

sensing an activation at a site between the two positions.

31. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation;

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having~~having~~ a given duration, at a delay after the activation, to the portion between two positions; ~~and~~

sensing an activation at a site coinciding with one of the two positions; and

determining said delay based on said sensing of the activation time.

32. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation;

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having~~having~~ a given duration, at a delay after the activation, to the portion between two positions;

sensing an activation at a site; and

estimating the activation of the portion from the sensed activation.

33. A method according to claim 32, wherein sensing comprises sensing a value of a parameter of an ECG and wherein estimating comprises estimating the delay based on a delay value associated with the value of the parameter.

34. A method according to claim 32, wherein the site is at a different chamber of the heart than the chamber at which the field is applied.

35. A method according to claim 32, wherein the site is substantially the earliest activated site in the chamber of the portion.

36. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation;

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having~~having~~ a given duration, at a delay after the activation, to the portion; and

applying a second non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals to a second portion of the chamber.

37. A method according to claim 36, wherein the second field is applied in the same cardiac cycle as the non-excitatory field.

38. A method according to claim 37, wherein each portion has an individual activation to which the applications of the field thereat are synchronized.

39. A method according to claim 37, wherein the second field has a different effect on the heart than the non-excitatory field.

40. A method according to claim 36, wherein only the second non-excitatory field is applied during a different cardiac cycle.

41. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation;

estimating the activation at the portion; and

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having~~having~~ a given duration, at a delay after the estimated activation, to the portion.

42. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation;

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and having~~having~~ a given duration, at a delay after the activation, to the portion; and

repeating application of the non-excitatory field, during a plurality of later heart beats, at least some of which are not consecutive.

43. A method according to claim 42, comprising gradually reducing the frequency at which beats are skipped during the repeated application.

44. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation;

applying a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals and havinghaving a given duration, at a delay after the activation, to the portion, wherein the portion has an extent; and

changing the extent of the portion to which the field is applied, between beats.

45. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation;

irradiating the portion with light synched to the activation, said light having an intensity which does not damage said portion; and

repeating the irradiating at at least 100 cardiac cycles, during a period of less than 1000 cardiac cycles.

46. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation;

irradiating the portion with radio frequency radiation synched to the activation, wherein said radiation does not generate a propagating action potential and wherein said radiation changes the response of the portion to an activation signal and wherein said radiation does not cause damage to said portion; and

repeating the irradiating at at least 100 cardiac cycles, during a period of less than 1000 cardiac cycles.

47. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

modifying the availability of calcium ions inside muscle fibers of the portion, to the activation, during a period of time including a time less than 70 msec after the activation, said modification of availability being made in response to the activation.

48. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

modifying the transport rate of calcium ions inside muscle fibers of the portion, during a period of time less than 70 msec after the activation, said modification of transport rate being made in response to the activation.

49. A method of modifying a force of contraction of at least a portion of a heart chamber, comprising:

providing a subject having a heart, comprising at least a portion having an activation; and

modifying the availability of catecholamines at the portion in synchrony with the activation, said modification of availability being made in response to the activation.

50. A method of modifying the activation profile of at least a portion of a heart, comprising,

mapping the activation profile of the portion;

determining a desired change in the activation profile; and

modifying, using a non-excitatory electric field which does not generate a propagating action potential and which changes the response of the portion to activation signals, the conduction velocity in a non-arrhythmic segment of the portion, to achieve the desired change.

51. A method according to claim 50, wherein the desired change is an AV interval and wherein modifying comprises modifying the conduction velocities of purkinje fibers between an AV node and at least one of the ventricles in the heart.

52. A method in accordance with any of claims 1-44, wherein the activation comprises an average activation of the portion.

53. A method according to any of claims 1-44, wherein the activation comprises an earliest activation.

54. A method according to any of claims 1-44, wherein the activation comprises a mechanical activation.

55. A method according to any of claims 1-44, wherein the activation comprises an electrical activation.

56. A method in accordance with any of claims 1-44, wherein the portion comprises a plurality of subportions, each having an individual activation and wherein applying a field comprises applying a field to each subportion at a delay relative to the individual activation of the subportion.

57. A method in accordance with any of claims 1-44, wherein applying a non-excitatory

electric field comprises driving an electric current through the segment.

58. A method in accordance with claim 57, wherein the current is less than 20 mA.

59. A method in accordance with claim 57, wherein the current is less than 8 mA.

60. A method in accordance with claim 57, wherein the current is less than 5 mA.

61. A method in accordance with claim 57, wherein the current is less than 3 mA.

62. A method in accordance with claim 57, wherein the current is at least .5 mA.

63. A method in accordance with claim 57, wherein the current is at least 1 mA.

64. A method in accordance with claim 57, wherein the current is at least 3 mA.

65. A method in accordance with any of claims 1-14 or 18-44, wherein the field is applied for a duration of between 10 and 140 msec.

66. A method in accordance with any of claims 1-14 or 18-44, wherein the field is applied for a duration of between 30 and 100 msec.

67. A method in accordance with any of claims 1-14 or 18-44, wherein the field is applied for a duration of between 60 and 90 msec.

68. A method according to any of claims 1-4 or 6-44, wherein the delay is less than 70 msec.

81. A method according to any of claims 1-44, wherein the electric field has a triangular temporal envelope.

82. A method according to any of claims 1-44, wherein the electric field has a ramped temporal envelope.

83. A method according to any of claims 1-44, wherein the electric field has a biphasic temporal envelope.

84. A method according to any of claims 1-44, wherein the electric field comprises an AC electric field.

85. A method according to claim 84, wherein the electric field has a sinusoidal temporal envelope.

86. A method according to claim 84, wherein the electric field has a sawtooth temporal envelope.

87. A method according to claim 84, wherein the electric field has a square-wave temporal envelope.

88. A method according to any of claims 1-44, wherein the portion of the chamber has an inside surface and an outside surface, wherein the field is applied along the inner surface.

89. A method according to any of claims 1-44, wherein the portion of the chamber has a normal conduction direction, wherein the field is applied along the normal conduction

direction.

90. A method according to any of claims 1-44, wherein the portion of the chamber has a normal conduction direction, wherein the field is applied perpendicular to the normal conduction direction.

91. A method according to any of claims 1-22 or 29-44, wherein the field is applied between at least two electrodes.

92. A method according to claim 91, wherein the electrodes are at least 2 cm apart.

93. A method according to claim 91, wherein the electrodes are at least 4 cm apart.

94. A method according to claim 91, wherein the electrodes are at least 9 cm apart.

95. A method according to any of claims 1-44, wherein the chamber is the left ventricle.

96. A method according to any of claims 1-44, wherein the chamber is the left atrium.

97. A method according to any of claims 1-44, wherein the chamber is the right ventricle.

98. A method according to any of claims 1-44, wherein the chamber is the right atrium.

99. A method according to any of claims 1-44 and comprising pacing the heart.

100. A method according to claim 99, wherein applying the electric field is synchronized with

the pacing.

101. A method according to claim 99, comprising calculating the delay based on the pacing.

102. A method according to any of claims 1-29 or 36-44, comprising sensing a specific activation at a site.

103. A method of modifying the activation profile of at least a portion of a heart, comprising,

mapping the activation profile of the portion;

determining a desired change in the activation profile; and

reversibly blocking the activation of at least a segment of the portion, to achieve the desired change, wherein the segment is not part of a reentry circuit or an arrhythmia focus in the heart.

104. A method according to claim 103, wherein the blocked segment is an ischemic segment.

105. A method of modifying the activation profile of at least a portion of a heart, comprising,

mapping the activation profile of the portion;

determining a desired change in the activation profile; and

changing the refractory period of at least a segment of the portion, to achieve the desired change, wherein the segment is not part of a reentry circuit or an arrhythmia focus in the heart.

106. A method of modifying the heart rate of a heart, comprising:

providing a subject having a heart with an active natural pacemaker region; and

applying a non-excitatory electric field, which does not generate a propagating action

potential, to the region, effective to modify the heart rate.

107. A method according to claim 106, wherein the electric field extends a duration of an action potential of the region.

108. A method according to claim 106, comprising, extending the refractory period of a significant portion of the right atrium.

109. A method of reducing an output of a chamber of a heart, comprising:

determining the earliest activation of at least a portion of the chamber, which portion is not part of an abnormal conduction pathway in the heart; and

applying a non-excitatory electric field, which does not generate a propagating action potential, to the portion, effective to reduce the output of the chamber.

110. A method according to claim 109, wherein the field is applied prior to activation of the portion.

111. A method according to claim 109, wherein the field reduces the reactivity of the portion to an activation signal.

112. A method according to claim 109, wherein the field reduces the sensitivity of the portion to an activation signal.

113. A method of reducing an output of a chamber of a heart, comprising:

determining an activation of and conduction pathways to at least a portion of the chamber; and

reversibly blocking the conduction pathways, using a locally applied non-excitatory electric field which does not generate a propagating action potential.

114. A method of reducing an output of a chamber of a heart, comprising:

determining an activation of and a conduction pathway to at least a portion of the chamber, which portion is not part of an abnormal conduction pathway in the heart; and

reversibly reducing the conduction velocity in the conduction pathway, using a locally applied non-excitatory electric field which does not generate a propagating action potential.

115. A method of performing cardiac surgery, comprising:

reversibly blocking the electrical activity to at least a portion of the heart using a non-excitatory electric field which does not generate a propagating action potential; and

performing a surgical procedure on the portion.

116. A method of performing cardiac surgery, comprising:

reversibly reducing the sensitivity to an activation signal of at least a portion of the heart using a non-excitatory electric field which does not generate a propagating action potential; and

performing a surgical procedure on the portion.

117. A method of controlling the heart, comprising,

providing a subject having a heart with a left ventricle and a right ventricle;

selectively reversibly increasing the contractility of one of the ventricles relative to the other ventricle.

118. A method according to claim 117, wherein selectively reversibly increasing comprises

applying a non-excitatory electric field, which does not generate a propagating action potential and which changes the response of the portion to activation signals, to at least a portion of the one ventricle.

119. A method of controlling the heart, comprising,

providing a subject having a heart with a left ventricle and a right ventricle;

selectively reversibly reducing the contractility of one of the ventricles, relative to the other ventricle.

120. A method according to claim 119, wherein selectively reversibly reducing comprises applying a non-excitatory electric field, which does not generate a propagating action potential and which changes the response of the portion to activation signals, to at least a portion of the one ventricle.

121. A method of treating a segment of a heart which induces arrhythmias due to an abnormally low excitation threshold, comprising:

identifying the segment; and

applying a desensitizing electric field, which does not generate a propagating action potential, to the segment, such that the excitation threshold is increased to a normal range of values.

122. A method of modifying an activation profile of at least a portion of a heart, comprising:

determining a desired change in the activation profile; and

reversibly blocking the conduction of activation signals across a plurality of elongated ~~fence~~ portions of the heart to achieve the desired change.